PIONEER FARMERS OF THE TRANSAMAZON HIGHWAY: ADAPTATION AND AGRICULTURAL PRODUCTION IN THE LOWLAND TROPICS

By

EMILIO FEDERICO MORAN

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PREFACE

This study concerns pioneers who are carving out new lives for themselves in the Amazon Valley. They are not settling along the traditional waterways, but along a long, upland highway. This was not a random migration of people, but one closely monitored and encouraged by federal agencies.

The central issue which led to this project was the potential of the Amazonian terra firme (upland) for intensive agriculture. However, while in the field other related problems and questions came to light. Among these were problems of ecological, social and institutional concern. The study of planned settlements per se became of immediate importance. Planning for this type of rural development necessitates understanding not only the physical setting of climate, soils, vegetation, and fauna, but also the colonists and their backgrounds. Of comparable importance is understanding the role of the government in implementing the project, and the population's adjustments to these plans.

The Amazon, like other frontier regions, is being occupied by pioneers who view it as a land of opportunity. Turner, in his interpretation of American expansion, proposed that the existence of a frontier gave an opportunity for the upwardly mobile to leave traditions behind and "escape from the bondage of the past" (1920:38). His theory suggests that people shed their cultural baggage and favor innovation when they go to a frontier area. Billington, Turner's current advocate, characterizes the frontier communities as having a "plastic social order ... a lack of tradition ... an absence of established producers ... and a need for labor-saving devices to offset a lack of manpower, all of which proved ideal testing grounds for anything that was new" (1967:16).

If, in addition to the "natural freedom" of the frontier, changes such as the creation of communities without long-held traditional controls and the use of modern technological innovations, are encouraged by powerful institutions, then even more rapid and radical behavior alterations might be expected in a pioneer population. Such an assumption was incorporated in the planning of Transamazon colonization, a major effort by the Brazilian government to open up its Amazonian frontier (Camargo, 1973:5-8). Whether these assumptions are actually verified by such changes in behavior will be the focus of this study.

The hypothesis presented here is that, in spite of the multiple opportunities of this planned colonization project, many of the social and economic behavior patterns of pioneer farmers tend to remain unchanged in the Amazonian frontier. As a corollary, it is postulated that the criteria used to select colonists were inadequate in eliciting behaviors that would lead to the achievement of project goals.

This study was carried out in two parts. First, a reconnaisance trip was undertaken in the fall of 1972 to choose an area of study. The field work was carried out between October 1973 and October 1974 in the region of the Xingú River, near the town of Altamira, in the Brazilian Amazon. Authorization for research was granted by the Brazilian National Research Council (Conselho Nacional de Pesquisas).

The first three chapters present examples of past directed colonization, the ideal scheme for the Transamazon Project, and general characteristics of the environment and the human population in the area. The research methods and choice of the community are discussed in Chapter II, rather than here, since the background material in the Introduction and Chapter I will be helpful in understanding the approach used in field work. Next, a typology of pioneer farmers is outlined which will be used to explain the adaptive strategies and agricultural performance of the colonists. Chapter V discusses land preparation, planting, harvesting and marketing practices, as well as ranching activities and farm production. The following chapter takes a critical look at the validity of widely held assumptions regarding the prediction of agricultural practices and presents a number of factors that act as constraints to agricultural production. Chapters VII and VIII then draw together this material to present the various ways in which the resources of the physical, social and institutional environments are used by each of the four groups characterized in the typology. Finally, Chapter IX recapitulates the major observations made and proposes ways to better accomplish colonization goals.

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PIONEER FARMERS OF THE TRANSAMAZON HIGHWAY: ADAPTATION AND AGRICULTURAL PRODUCTION IN THE LOWLAND TROPICS

By

Emilio Federico Moran

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Chairman: Charles Wagley
Major Department: Anthropology

This study deals with the Brazilian efforts to settle and develop the Amazon Basin. In 1970 the Transamazon Highway was begun and a planned colonization scheme put into execution. By 1971 a number of planned communities were already built and inhabited by migrants selected by the Brazilian Colonization Agency. One of these planned communities was chosen to study the ecological, social and institutional adaptations of pioneer farmers coming from all parts of Brazil.

The research focuses on whether behavior changes rapidly due to the "freedom of the frontier" or whether social and economic behavior tends to remain unchanged in the frontier zone. A corollary of the hypothesis is that the criteria used to select colonists were inadequate in eliciting behaviors that would lead to the achievement of project goals.

The Transamazon Colonization Project is particularly useful as a study site because, in addition to the reputed frontier opportunities, colonization plans set out to change the behavior of a majority of the settlers. Colonization goals were to increase surplus agricultural production and solve the problems created by large masses of landless agrarians from the Northeast

The ecological setting is the terra firme tropical moist forest drained by the Xingú River. The region is composed largely of soils originating from chemically basic rocks. The area rests on a low plateau which dates from the Tertiary and Quaternary periods. The undulating relief shows a predominance of latosols and podzols at high points, and hydromorphic soils at low points. Soils have low phosphorus levels but forest clearing through burning makes a substantial contribution of this nutrient available to plants.

The social setting is a government-built village made up of 48 standardized houses, with provision made for basic health and educational services. Inhabitants came from 11 states representing the regional subcultures of Brazil. The personnel of institutional bureaucracies were localized in a planned town and expected to provide community leadership in the planned villages.

A four-category typology based on life history material is used to explain the economic strategies chosen by the farmers. It is not region of origin, education, or unspecific agricultural experience which is associated with successful agricultural production. Rather, previous ownership of land and infrequency of migration more closely explain farm management capability.

The most serious obstacles to Amazonian development are not ecological but social and institutional. Inflexibility in credit administration was more costly to farmers than lack of health. Inadequate side roads prevented agricultural production from being marketed. Misunderstanding between the urban government agents and the rural farmers are based

on different cultural expectations. These differences in outlook present serious obstacles to project execution.

The Transamazon Project is not a failure but it does need redefinition if it is to provide a more permanent solution to settlement in the humid tropics. Owners of small properties who have had stable employment histories should be given preference over sharecroppers and wage laborers in the selection of colonists if visible results are expected in a relatively short period. Furthermore, rural development requires improvement of local people rather than continuous dependence on outside personnel for leadership and services.

Charles Wagley

Charles Wagley
Chairman

INTRODUCTION

In 1970, the Brazilian President, Emílio Garrastázu Médici, ordered the establishment of a Program of National Integration (PIN),[1] the aim of which was to integrate the vast but largely untouched resources of the Amazon Basin into the strategy of national economic development. The Program got off to a dramatic start with the construction of the Transamazon Highway, a 5,400 km. road (Resende, 1973) extending from the cities of João Pessoa and Recife on the Northeast coast, to the frontier with Peru (See Figure 1).[2] In conjunction with this ambitious road-building scheme, the government set aside 100 kilometers on each side of the Transamazon Highway for colonization.[3] Ten kilometers were allotted for small farm colonization, and 90 kilometers for large scale cattle ranches and forestry operations.

The Brazilian program to integrate the hitherto undeveloped and relatively uninhabited Amazon region into national life has deep roots in the nationalistic dreams of Brazilian intellectuals and politicians. It became explicit in 1940 when President Getúlio Vargas announced his famous intent for Brazil to "march to the west," in which the conquest of the Amazon was considered the "highest task of civilized man." But the dream remained inactive until the 1960's (Wagley, 1974:5).

In 1965 the opening of the Belem-Brasilia Highway[4] permitted for the first time overland access to Belem from the northeast coast, and from there to the industrial South.[5] In 1966 the ineffective

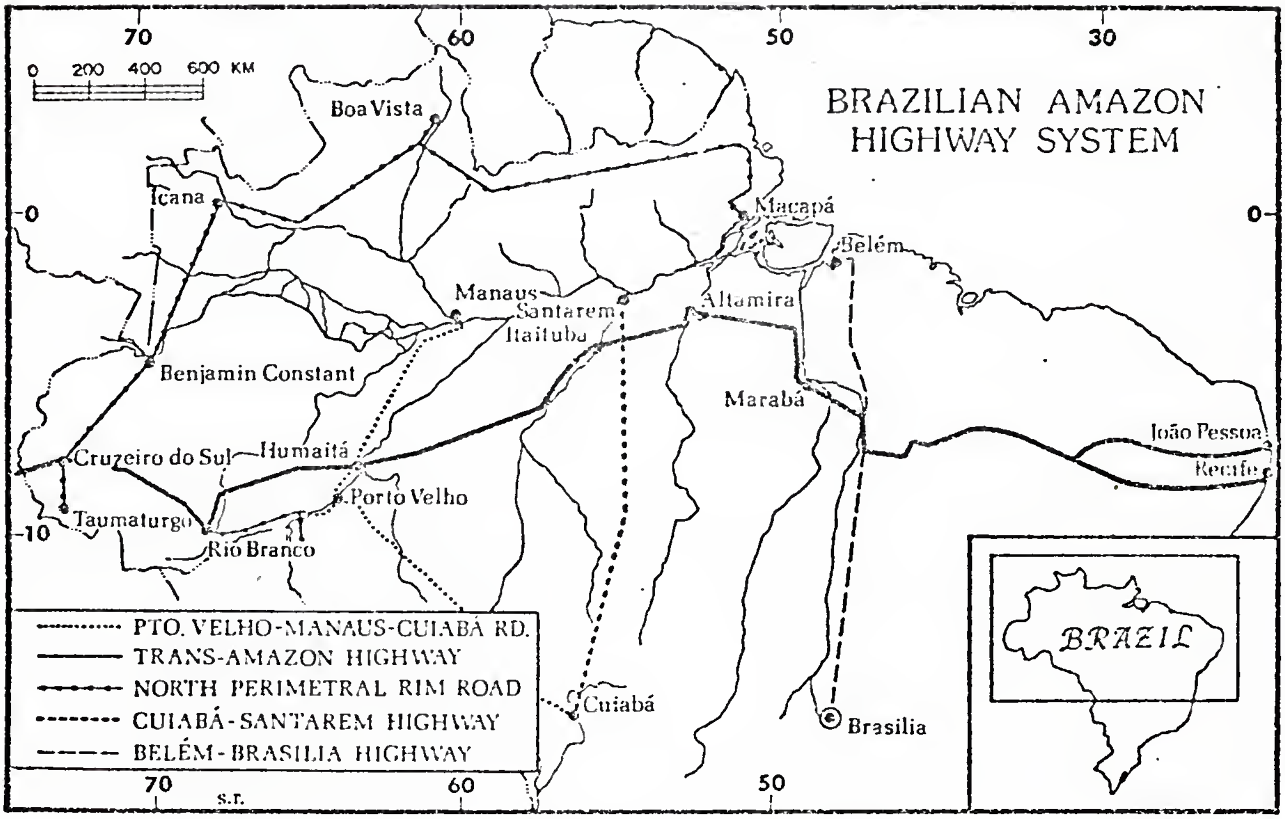

Figure 1. Brazilian Amazon Highway System

Source: Charles Wagley, ed. Man in the Amazon, p. 292.

Superintendência de Valorização da Amazônia (SPVEA) was replaced by the Superintendência de Desenvolvimento da Amazônia (SUDAM). SPVEA had been founded in 1953 to spend 3 percent of the Federal Income Tax allotted to Amazon development, but it spread its investments too thinly and accomplished little (Kleinpenning, 1975:159). For its first four years, it seemed as if SUDAM's future would be no more rewarding than that of the defunct SPVEA. But in 1970, SUDAM was boosted with additional power and funds from the federal government. It was given the important task of planning and administering many of the activities which soon promoted Amazon development.

Such developments did not come as a complete surprise to those familiar with the Brazilian economy. During the 1960's, Brazil had been experiencing a new boom, based not on coffee but on industrial growth. Such growth led to major profits in all sectors of the economy, profits that now could be drawn upon by the more efficient federal tax collectors (See Table 1).[6] In this source of federal funds, Brazilian planners saw the opportunity to expand the agricultural frontiers into the vast West and North. Such interests first led to the development of new lands in many areas of Goiás, Minas Gerais, and Mato Grosso. Only the frontier of the Amazon Valley as yet lay untouched.

In 1970, disaster struck the Northeast region. For the previous ten years, many hopes had been pinned on the effectiveness of the Northeast Regional Development Agency (SUDENE) in buffering the potential impact of recurrent drought on the region's population. However, the effects of a new drought proved to be as cruel as other droughts which had preceded it.[7] This confirmed the view of critics who had suggested

TABLE 1

BRAZIL--INDICATIVE RATES OF GROWTH IN RURAL OUTPUT, AGRICULTURE AND THE ECONOMY, 1960-70

Year	Indices	
	Agriculture	All Sectors
	----------------1949 = 100-----------	
1960	156.1	205.7
1961	167.9	226.9
1962	177.1	238.8
1963	178.9	242.5
1964	181.3	249.6
1965	206.3	256.4
1966	199.8	269.5
1967	211.1	282.4
1968	214.0	308.7
1969	226.8*	336.5*
1970	239.5*	368.5*

	Growth Rates (1967-70)	
	Agriculture	All Sectors
	----% Annual Compound---	
1960-70	4.1	5.5
1965-70	3.4	7.8

*Preliminary figures.

Source: International Bank for Reconstruction and Development, [illegible] 1973: Table 7.1.

that SUDENE's emphasis on capital intensive industrial development was not a solution to the pressing agrarian disparities of the region. SUDENE itself had been created after a drought in 1958. During the 1960's its attention was concentrated on hydroelectric programs, improving transportation and industrialization. Such policies had little impact on relieving the poverty of the Northeast because the agricultural sector was relatively neglected. In addition, the industrialization program had failed to generate enough employment for the swelling urban labor force (International Bank for Reconstruction and Development, 1973:43).

Northeastern agriculture has always been technologically backward and rigid in its social class arrangements (Paiva _et al._, 1973:373). Absentee landlords control most of the land, and the large rural population of the region ekes out a bare existence through wage labor, sharecropping, or _minifundio_ subsistence agriculture (Nicholls, 1974). Such a situation has been so unbearable that Northeastern populations have for many years supplied the manpower needed to open up the moving frontiers of Brazil (Margolis, 1973:35). In the Rubber Era alone an estimated 300,000 northeasterners were recruited to work in the rubber tree stands of the Acre and Amazon regions[8] (Vergolino, 1971). Those who survived the boom were either absorbed into the local _mestiço_ population or returned to the Northeast to tell their tales of suffering. The opening of the southern frontiers of Bahia, São Paulo, and Paraná was also facilitated by the large numbers of migrating workers coming from the impoverished Northeast. Those who came early became land-owners themselves. Those who came later became sharecroppers and wage laborers. As in the Northeast, the sharecroppers often found they were forced to move on as their plots were claimed by the landlord for pasture or other crops. For those who were constantly pushed out by climatic or economic forces, the frontiers had offered at least some semblance of hope (Schuh, 1970:31-33).

With the coming of the drought the time was ripe for the push to develop the Amazon. The government saw this effort as an "escape valve" or funnel for the great masses of the Northeast (Ministério da Agricultura, 1972a:1). The publicized cry became "to give men with no land, a land with no people." While Brazilians will claim this as the primary motive of Amazon development, others have suggested that "it is hard to see how the transfer of several hundred thousand, [or] even two to three million, people from the Northeast into Amazônia can possibly make any more than a dent in the problem of poverty" (Wagley, 1974:6). In addition, the settlement of families is proceeding at a much slower pace than originally forecasted. Less than 6,000 families have been settled in four years, a figure much lower than the 100,000 families forecasted by the government in 1971 (Kleinpenning, 1975:92).

However, the job of moving any sizeable group to the Amazon is a complex problem. For instance, early in the project, the government recognized that the Amazon region was much feared and mythologized, and that men normally went there only under duress. The Northeasterner in particular had built up an apprehension toward migration to the area. The tales of the rubber gatherers who survived the debt slavery in the Amazon and returned to their native land gave the Amazon more than its share of colorful fiction. With available lands elsewhere, such as in the Center-West, the rural poor would not opt to migrate to the tropical Amazon Valley on their own. Therefore, an impressive package of benefits was offered to families willing to leave the relatively tame environments of the Northeast, Center-West and South, and brave the last great frontier on earth.

While the 20 kilometer small-farming belt might appear minute when compared with the expansive Amazon, it nevertheless comprises an area of approximately 108,000 square kilometers, an area larger than that of some countries in Europe. As in the construction of Brasilia, Brazil set out to complete these herculean tasks of road building and colonization in record time. By September 1972 the first half of the highway had been cut as far as Itaituba on the Tapajós River (See Figure 1). The second half is awaiting completion in the latter part of 1975. However, the rush to build such an extensive road system, and indeed the push to develop the Amazon goes far beyond the concern for the landless masses that are to become colonists.

The all-out effort of Brazil is most probably motivated by both economic and political considerations. The spectacular iron deposits of the Serra dos Carajás,[9] the widespread mineral wealth discovered with the help of infrared photography,[10] the discovery of reasonably good lands for agriculture (Falesi, 1972), the largest expanse of forest in the world with an estimated yield of 178 cubic meters per hectare (SUDAM, 1974:11), and the long-standing fear of covetous foreigners (Reis, 1968) all lent impetus to the Highway Project. Fears that the Andean nations might wish to regain their lost Amazonian territories were rejuvenated by the fact that colonization often followed the discovery of oil fields on the borders of these nations.[11] To date, the process of road building on the Andean side of the jungle has been slow, but with increased capital from oil leases, efforts are increasing. Figure 2 gives an idea of the highway network that is supposed to "enmesh the Brazilian bull" (Tambs, 1974:78). Brazil therefore has countered with its own road construction, investing capital resources and nationalistic excitement unmatched on the other side of the frontier (Tambs, 1974:79).

Basically, the development of the Amazon is being encouraged in three different areas: industrialized exploitation of natural resources, large-scale cattle ranching, and small-farm colonization. First, efforts are being made to attract large private corporate enterprises, Large land concessions have been granted to both Brazilian and foreign business groups. U. S. Steel, Bethlehem Steel, Georgia Pacific, Alcoa, King Ranch, and Swift-Armour are among the first United States companies to take advantage of the opportunities available in the region. One extensive concession, estimated to be 1,500,000 hectares, will include pulp woods for a paper industry, aluminum ore mining and processing, cattle and buffalo grazing, and rice plantations.[12] Corporations from European nations have also been granted concessions. Holland's Bruynseel and Germany's Volkswagen, for example, have acquired large areas for wood exploration. Secondly, southern Brazilian companies are investing heavily in cattle ranching and expanding from current holdings in southern Pará, Mato Grosso, and Goiás. Well over two-thirds of the projects approved by SUDAM deal in livestock production (SUDAM, 1972). The marked six-month dry season of the

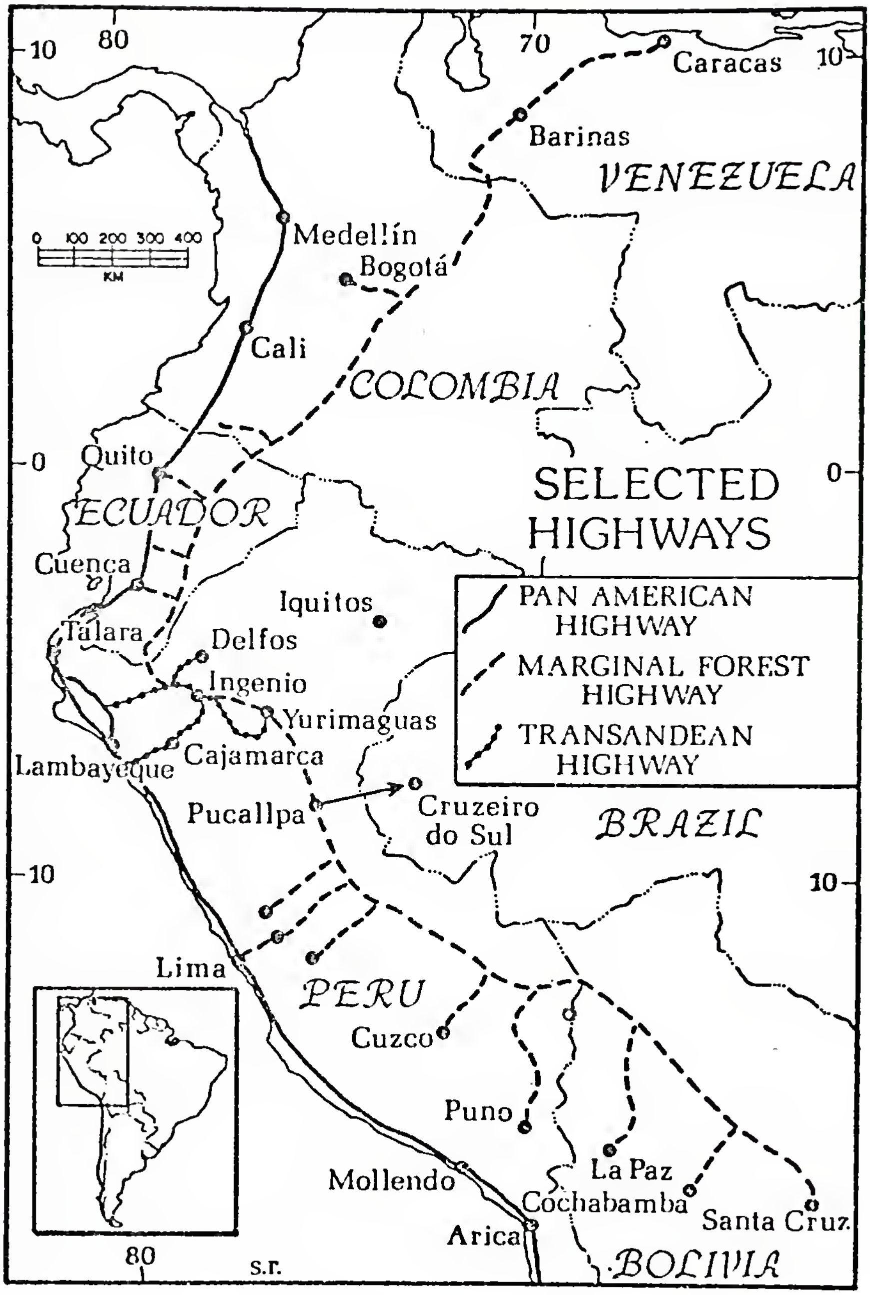

Figure 2. Selected Highways

Source: Charles Wagley, ed. Man in the Amazon, p. 76.

plateau or planalto in these regions is an important limiting factor to cattle development (Conrad, 1975, personnal communication). The Amazon, on the other hand, has a mild dry season of no more than two or three months. Therefore, the potential for fattening cattle is much higher in the Amazonian terra firme than in the central plateau.

These large operations are just getting underway and few results can as yet be seen. On the other hand, the third area of development, small farm colonization, began with the same enthusiasm as the highway and, after three years, is subject to examination. Some 5,000 families in three separate colonization projects are adjusting to a new physical and social environment. It is their adaptation and agricultural performance that is of interest to this study.

Brazil's reasons for developing the Amazon are not solely based on a cost/benefit analysis, nor on pure political paranoia. Brazil's boom must also seek new outlets for investment. Economists recognize that purely industrial development, to the neglect of the agricultural sector, can lead to circular effects that in the long run work against economic development and growth. This is precisely what occurred in the Northeast during the 1960's. Clearly, the policy for the 1970's is to develop the agricultural sector in both North and the Northeast regions. The expansion of the agricultural frontier has traditionally been Brazil's way of augmenting the output of its farm sector. For example, agricultural production grew more rapidly than population in the 1950's and 1960's without any significant increase in yields per hectare or efficiency of agricultural methods. This was largely accomplished simply by expanding the cultivated area (USDA, 1970: xv).

Again such a path was chosen in calling for a big push into the Amazon. Since governments must keep balance between economic growth goals and the requirements of social welfare, Brazil saw the vast undeveloped lands of the Amazon Basin as a solution to these two major economic problems (Ministério da Agricultura, 1972a:1).

NOTES

[1] The Programa de Integração Nacional (PIN) was created by decree 1106/70 and allocated two billion cruzeiros for its first phase (1971-74)--(INCRA, 1972b). See Appendix 1 for a list of Brazilian institutions and development plans, with appropriate achronyms.

[2] The link will be between the Brazilian town of Cruzeiro do Sul and the Peruvian town of Pucallpa.

[3] The many and confused meanings of the word "colonization" have been reviewed by Smith (1969). Here the term is used to include both "spontaneous settlement" and "official colonization."

[4] This highway was only completely paved by 1973. Before this date it was, like the Transamazon Highway, a dirt road.

[5] The road, however, was not always passable and uncompleted stretches between Belem and the Northeast forced travelers to go south to Brasilia first, before going to the other region. Valverde and Dias (1967) opportunely studied the Belem-Brasilia Highway and discuss its rich potential.

[6] "Brazil's rapid growth is no miracle; rather it is the logical result of improved economic management ... industry would continue the 11 to 12 percent growth pace it has achieved since 1968" (International Bank for Reconstruction and Development, 1973:iv). By contrast, agriculture grew at a rate of 4.4 percent over the last two decades.

[7] A report on that drought indicated that more than 400,000 families were victims of famine and that people had taken up crime as a solution to hunger. Trains and trucks were held up in the search for food (Brazilian Information Bulletin, 1974:12-13).

[8] In 1878 alone, 54,000 northeasterners migrated to the Amazon (Tambs, 1974:72).

[9] Total reserve is estimated at 8,000 million tons (Kleinpenning, 1975:13).

[10] RADAM (*Radar da Amazonia*) has identified large deposits of iron, tin, copper, lead, zinc, aluminum, gold, silver, chromium, manganese and other ores (Kleinpenning, 1975:13).

[11] The Baron of Rio Branco acquired much of those foreign territories, through astute diplomacy and the infiltration of Acre with Northeasterners. For example, Bolivia, in 1903, lost 191,000 square kilometers to Biczie (Tambs, 1974:72-73). Tambs also adds that infiltration through colonization has been a time-tested method of Brazilian expansion (1974:61-75).

[12] National Bulk Carriers is the corporate name of the firm that has so far received the largest landholding in the Amazon (Kleinpenning, 1975:73).

CHAPTER I

COLONIZATION AND ADAPTATION

Green Hell or Paradise?

The thrust to develop the Amazon Valley goes against many long-held opinions concerning the potential of the humid tropics for civilized human occupation. Some have believed that the tropical climate has a deleterious influence on non-indigenous people[1] and that, if endured for many years, physique, energy, fertility, and resistance to disease are diminished (Price, 1939:6). Environmental determinist writers, whose heyday is past, reach even for simile to portray the effect of hot environments on outsiders: "In the tropics, flowers bloom early but wither quickly, and similarly the majority of the local inhabitants reach old age when Europeans have barely attained middle age" (Black, 1932:101).

A number of writers in the early part of this century advocated a point of view that made environment all-important. In the present century the environmental determinist viewpoint has been promoted by several writers. Most prominent among these are A. Grenfell Price, Griffith Taylor, and Ellsworth Huntington. Taylor developed a "scale of discomfort" that emphasized the "oppressive high average humidity and heat" that lead to the alleged breakdown of white settlers (Price, 1939:197). Huntington postulated that every organism, including man, has an optimum climate. Therefore tropical conditions make human settlement and the evolution of a high civilization extremely difficult (Price, 1939: 199). A major cause of tropical maladjustment afflicting settlers, called "tropical neurasthenia" is described as follows:

> The settler is exiled from home; often separated from his family; generally unable to make ends meet for some reason or other; suffering in many cases loneliness and lack of congenial society; envious of others; disappointed over promotion; with ambition thwarted. Living amidst a native population causes him annoyance at every turn, because he has never troubled to understand its language and its psychology. From early morn till dewy eve he is in a state of unrest--ants for breakfast, flies at lunch, and termites for dinner, with a new species of moth every evening in his coffee. Beset all day by a sodden heat, whence there is no escape, and the unceasing attention of the voracious insect world, he is driven to bed by his lamp being extinguished by the hordes which fly by night only to be kept awake by the reiterated cry of the brainfever bird or the local chorus of frogs. Never at rest! Always an on-guardedness! (Price, 1939: 211-212).

But Price did not attribute it all to climate. Part of the difficulty, he recognized, was due to "absurd conventions of dress,"[2] heavy and chronic alcohol intake, inadequate diets for tropical regions, and lack of exercise, in short, culturally maladaptive behavior. "Almost every tropical settlement has its quota of lazy, bored, card-playing, spirit-drinking women who would be far healthier and happier if financial circumstance forced them to do their own housework" (Price, 1939:226). The same is true, he says, for men, who dominate the natives and believe them to be more fit to work in tropical regions. This is related to a racially separatist policy that tries to preserve superiority by avoiding manual labor. "Only too often a white man goes to the tropics with the fixed idea that he will die if he works" (Price, 1939:226). Price (1939: 236) agrees that "national policies such as the 'white Australia' policy may have a biological as well as social basis." Within the environmental determinist school of thought there is an easily detectable racial bias which in large measure explains their opinion of the tropics.[3]

Not everyone believes the tropics are hell on earth. Paradise itself is often depicted as tropical. In the tropics one can live comfortably with a minimum of clothes, everything that is planted grows year-round, and exotic and beautiful species of plants and animals can be encountered. But our romantic image of life in this tropical paradise is eventually tainted by other facts about the tropics. While balmy weather allows light clothing, insect pests do not. Abundant rainfall that aids plant growth also provides an excellent environment for malarial mosquitoes. The disillusionment that follows the dream leads to the type of sentiments which found their greatest expression among the environmental determinists mentioned earlier (Wagley, 1974:3-4).

More recent authors have suggested that the tropics are a "counterfeit paradise." Meggers (1954, 1971, 1974) has emphasized this aspect of the argument by affirming that some environments place limits on the evolution of culture. She emphasizes the physical difficulties of the climate, soils and topography which, in her view, would be extremely difficult to overcome, if one intends to establish modern facilities. She does not feel such development to be impossible, but that at this time there is not enough knowledge about the tropics in order to develop such regions effectively (Meggers, 1971:154). The ecological balance of the tropical forest is such a delicate one that Meggers seems to propose that low levels of dispersed peoples with less-than-modern technology, are better able to cope with such an environment.

The tropics, then, stand out in her work as regions with "low potential" for modern societies and would be better left alone. More specifically, the plans to open up the Amazon lowlands to human occupation on a large scale "will not work and cannot work because they are incompatible with the realities of the Amazon environment" (Meggers, 1974:108).

This study will argue that it is unrealistic to think that a nation will forever maintain 59 percent of its territory as a forest reserve. The knowledge that should help government planners make more rational decisions has not been forthcoming. Like most of the tropics, the Amazon has remained exotic and forbidding, a research refuge only for the naturalist. Even today ecologists and other scientists are not flocking to this natural laboratory.

If the lowland tropics are so full of unknowns, as every writer on the subject prefaces and concludes his writings, why has so little been done? One can argue that the opening of the Amazon Basin by a network of roads has opened the door and provided the basic necessities for scientists to study the complex networks of plant, and animal life in the tropics. Equally important, is the need to study human adaptive behaviors that may aid outsiders in occupying such a territory. The early environmental determinists were essentially describing the miseries of a white society that attempted to maintain aristocratic airs in the tropics. Their boredom and subsequent demise was not an effect of the climate, but of their own cultural unwillingness to learn from the native inhabitants. Rather than stress the environmental control of man's behavior, or the ecological limitations of his society, we would rather emphasize the interaction of cultures and their surroundings. This will entail using a cultural ecological point of view.

Adaptation

In essence, cultural ecology refers to the interaction of environment and socio-cultural factors (Heider, 1972:207). In this interaction, each of these systems affects the other. Changes in nature prompt reactions in the social system of the population and changes in their technological system affect the environment. Individual adjustments, once successful, become widely used by the rest of the population and constitute adaptive behaviors. This set of coping behaviors, or ways of dealing with people and resources in order to obtain goals and solve problems, is what we call adaptation (Bennett, 1969:11).

Adaptation in this context is concerned with "groups" and "populations," not with individuals (Hawley, 1973). Groups and populations, however, are not directly observable. They are abstractions about the behavior of individuals. It is from the observation of individuals that we can derive statements about the adaptive strategies of the population. It is in this area of research, the observation of the individual, that the "cultural materialist" strategy of Harris (1968) and others interfaces with the point of view of this study. Harris is concerned with actual observation of behavior and the influence of techno-material life on the shaping of cultural features. While techno-environmental changes infer response to a changing environment, men also shape their environment and are not merely directed by it. Environment does set certain limits on the development of cultures (Meggers, 1954), but only because of certain technological constraints. Practically speaking, all environments have potential if man has the tools to exploit them. With the rapid changes in technology, previously unproductive environments for man can be made to yield abundantly. In agreement with Ferndon (1959), this study espouses the conviction that bottlenecks to an area's potential can be overcome through cultural innovation and/or availability of appropriate technology. But before such innovation occurs, the population must be forced into higher "investments" of available capital and human resources.

The Introduction suggested that the Brazilian government under the guise of "national security" uses the availability of vast land resources and the existence of large number of landless agrarians as a motive to occupy the Amazon Basin.

Unlike spontaneous colonization movements which included many traditional peasants, the Transamazon situation is not meant to evolve into one of subsistence activities, regional isolation and traditionalism. A modern agrarian society is planned in which farmers can acquire ready-made adaptive solutions to their problems from extension agencies; capital loans from national banks; and new plants and animals from governmental research sources.

This participation of the Transamazon colonists in the greater national markets, consumption patterns, communications media, and culture in effect makes them representative of the national society. This participation both simplifies and yet complicates the task of the analyst. Brazilians, unlike many other Latin Americans, all share in a single national culture and in only one language (Wagley, 1948). On the other hand, they also possess regional subcultures designed to cope with local conditions. A cultural ecological analysis will consider the effects of both patterns in the workings of the Transamazon project. For instance, making a living in the Transamazon is contingent not only on adaptation to the physical environment, but also to the social and institutional environment created by the various governmental agencies.

In this study, therefore, adaptation will be measured by a series of material and behavioral indicators such as income, liquid assets, farm yields, use of available resources, financial solvency, health status and social organization. We will not describe every aspect of social life and economic activity, but only those that are clearly related to economic survival and the processes of adaptation to the lowland tropics.

Colonization in the Tropics

The Transamazon is a case of directed or planned colonization. As such, the government is the prime mover of development. Official planned colonization is generally characterized by a high degree of government control of the size and location of farms, selection of pioneers, land clearing, resale of land, crops used, management practices, credit availability, and community organization. Such control is exercised usually in the development of virgin lands as these involve much greater difficulty and expenditure of resources. More than one hundred such projects have been undertaken over the past 30 years in virtually every Latin American country with undeveloped tropical lands (Nelson, 1973:74).

Planned colonization has been greatly criticized, largely because it is more expensive and is usually tied to a political regime and its particular ideology. A second option open to planners would be to simply open an area to spontaneous colonization. In a review of 24 types of colonization projects in Latin America, Michael Nelson (1973) points out that spontaneous colonization appears to be more efficient in agricultural production than the planned projects. This seems to be explained by the presence of a higher percentage of former farm owners and persons with some tropical experience. The fact that many such farmers also have lower levels of education leads Nelson to correctly surmise that education may not be important in the early stages of colonization.[4] In general, one can say that spontaneous settlement has attracted more of the sorts of people who can succeed in these areas than have the planned programs, despite the latter's selection criteria and other controls. Dozier (1969:200) points out that spontaneous settlement is, by its very nature, selective. Few persons without the needed endurance and experience will remain in the rough environment of a frontier area. By contrast, planned colonization is widely publicized and tries to attract people through the promise of real or implied subsidies. Persons of questionable qualifications for surviving a frontier situation may get by unless stringent controls are used in the process of colonist selection.

Directed and semidirected colonization programs tend to suffer from the lack of credit, passable roads, declining yields, inadequate markets for produce, and naive advisors. Though many regional development projects have been executed in the humid tropics, few have adequately been studied. Mexico's Papaloapan Basin Project, however, is one exception. The Papaloapan Project was the first centrally coordinated regional development scheme in Mexico. It began in 1947 with the intention of integrating the Papaloapan Basin, an area 17,800 square miles, in Southeastern Mexico, into the productive agricultural sector. Roads have joined the Basin to the rest of the country and opened up markets for its production. Flooding has been brought under control by the Aleman dam. These, in short, constitute the Project's major contributions to regional development, after its first fifteen years of existence (Poleman, 1964:110). However, the hydroelectric potential of the dam is underutilized. Development in the agricultural sector did not match the infrastructural opportunities. Two-thirds of the funds allotted for the project were eventually spent in irrigation projects.

The Project's disappointing agricultural benefits were a result of an inadequate understanding of tropical agriculture. Agronomists were put in charge of management, and settlers given only a minimum of latitude for exercising personal judgement.[5] There was little selection of potential settlers, and nearly anyone who applied was allowed to participate. A majority of settlers came from the highlands. Energetic and bright colonists were treated paternalistically and given no opportunity to exercise responsibility (Poleman, 1964:139). The lack of basic knowledge about the Basin's ecological conditions soon began to take its toll. After only a few months, it was patently clear to many settlers that they were being poorly advised. Since there were no readily available natives of the region to whom to turn, the turnover of colonists was great.[6] Errors in crop selection, management techniques, and judgement led to consistently low yields, and a standard of living below that of the regions from which the colonists had come (Poleman, 1964:141). "What seems surprising is not that so many colonists became discouraged and left, but that so many stayed as long as they did. The Mexican peasant will tolerate much for an opportunity to improve himself" (Poleman, 1964:142).

The Papaloapan Project taught planners that in tropical agricultural development, capital investment cannot make up for inadequate knowledge and a shortage of skilled personnel (Poleman, 1964:155). Given the enormous amount of funds poured into the Basin, the tangible benefits to the agricultural sector were far too modest. The account of the serious disruption of the lives of those families who were forced to relocate out of areas flooded by the large hydroelectric dam did not even appear in the project results. The dam itself serves few local consumers, and its electricity is shunted to far away urban centers.

Spontaneous settlement is also plagued with problems which are similar to those in directed colonization. Wesche's study of the spontaneous migration to the Putumayo region (1967) suggests that climate is not a major problem for highland-to-lowland migrants. The immigrants in fact preferred the lowland climate to that of the sierra, and highlanders expressed little difficulty in adjusting to the heat and humidity (Wesche, 1967:213). He found that even disease had more to do with economic status and education than with the environmental conditions of the tropics (Wesche, 1967:218). More important than the effects of the physical environment was the lack of adequate transportation facilities and the performance of the agricultural extension service (Wesche, 1967: 12, 225). What this and the previous studies suggest is that tropical heat and humidity do not inhibit development of these regions but, rather, elementary human and institutional malfunctioning[7] (Crist and Nissly, 1973:8).

Promoting Transamazon Colonization

Transamazon Highway colonization is a case of directed colonization. The development scheme was based on numerous assumptions that shaped the government strategies and the outcome of the project. It was assumed that education, years of agricultural experience, and size of family were important criteria for colonist selection. The colonization blueprint gave preference to big families and hoped that a minimum family labor force of 2.5 persons would be selected.[8] According to the plan, such a labor force would preclude the need for hired labor. It was also assumed that extensive agricultural experience should be a prime requirement. The way this information was elicited was by simply asking how many years of agricultural experience the individual had had, rather than pursuing a careful employment history to identify the kind of experience acquired over the years. Years of schooling was also part of the selection process but this item was not sufficiently weighted to bring the more educated colonists to the area.

Preference was given to agriculturally experienced persons between the ages of 25 and 45, who were married and had families who could help them on their new land holdings. Such families easily scored over the 500 points necessary for selection. Families with many children were given precedence over those with few, everything else being equal (Kleinpenning, 1975:117). Selection criteria were not always rigorously applied and, as will be seen later, not always adequate in selecting those with the best capacities to work in the Transamazon.

The interest in moving to the Amazon was stirred among the landless in Brazil through both the media and through personal contact. Agronomists and extension agents approached the farmers in their area who the technicians thought would be good candidates. Protestant Church leaders used their pulpits to make the congregation members aware of the opportunities to "seek a promised land." Letters from the first pioneers to those back home encouraged many to apply who otherwise might never have come. Those who wished to settle the Amazon had to present themselves at local colonization agency offices and fill application forms. Numerous papers had to be sought for all members of the family: identity cards (carteira de identidade), voter's registrations, a workers' certificate (carteira de trabalho), statements of good character from the county police, and health certificates. In some areas applicants were given an agricultural-knowledge examination, but this proved to be more of a bureaucratic formality than an effective means to sift out inexperienced farmers. For instance, a literate ex-soldier who had never done farm work went to the library, read a book about agriculture, and took the test. He was one of the first selected.

An attractive package of benefits was also offered to the farmers. One hundred hectares of virgin land along a federal highway were to be given, complete with boundaries and titles supported by the federal Colonization Agency (INCRA). Guaranteed financing to all was offered by the Bank of Brazil, according to the area cleared and planted in rice, corn and beans. Household subsidies, in the form of a six-month minimum salary for each family head helped to tide the family over until the first crops were up. These were paid by the colonization agency. In 1971 the colonists received Cr$204.00 per month plus food subsidies. These food subsidies were later cut out, and the salary was raised to cover the food budget. The minimum wage was constantly adjusted for inflationary increases in the economy. By 1974 the salary had risen to Cr$308.00 spread over a period of eight months, instead of six. All salaries and food stuffs were equally apportioned, regardless of the number of members in each family. This payment was not like welfare in that each colonist was expected to pay back the initial salaries and food subsidies within three years. In the early stages, wages for work on local projects, such as building the agrovilas and other public buildings were also allowed.

Government-built houses on the individual lots, schools, medical facilities, tools, household items, technical aid, and transportation of farm produce were also promised the colonists. Clapboard wooden structures of five rooms and 51 square meters of living space were built in a standardized form to facilitate speed of construction.[9] Teams of five persons could put up one house per day after a couple of days of practice. Primary schools of similar construction were built in the agrovilas, and teachers were enticed by a "hardship" bonus to come and teach there. Secondary and vocational schooling was available in the agropolis and in the older towns of Altamira, Marabá and Itaituba. A medical post was built in each agrovila, and doctors were expected to pay visits each week. A nurse's aide was placed in each agrovila along the main highway to take care of minor first aid problems.

Because of increased transportation problems caused by excess baggage, or because it was truly believed that the promised bounties offered by the federal government would be bestowed upon Transamazon lands, farmers were advised to leave most of their tools and household items behind. Some farmers were reportedly told that "they would find their houses completely equipped with furniture, agricultural tools, pots and pans, and any necessary household goods." Some colonists were doubtful and brought what they could fit inside suitcases. The majority gave their few material possessions to friends and relatives. Their poultry and pigs were sold in order to buy the clothes and suitcases needed for the journey and to cover expenses in passage.

A body of agronomists and extension agents was recruited mainly from southern Brazil to administer the various programs that were established by all the participating agencies (SUDAM, 1971:3). The main group, that of the Colonization Agency, was charged with choosing the colonists, bringing them to the area, processing them on arrival, settling them on their land, and guaranteeing that their land rights would be protected. Many agronomists took up the call as volunteers, attracted by the patriotism associated with the move and the substantial "hardship" bonuses and free housing given by the government. Many of the takers were young and ambitious civil servants who saw in the frontier a quick avenue for professional advancement.[10]

Second only to INCRA were the extension agents of ACAR-Pará (Associação Brasileira de Crédito e Assistencia Rural do Pará).[11] While some of them were agronomists, the majority had had only a short course in extension education (curso técnico) of about three months. They tended to be young and urban, many still in their early twenties. They were charged with supervising the labor of farmers, facilitating the obtention of bank loans; giving technical aid in modernizing farm practices; and making seeds and varieties available to cooperating farmers. A contingent of ACAR female social workers were expected to give classes in hygiene, cooking, and vegetable garden preparation to the women in farm communities. INCRA, IPEAN (Instituto de Pesquisa e Experimentação Agropecuária do Norte), and DEMA (Departamento do Ministério de Agricultura) also had personnel present in the area to advise farmers besides ACAR-Pará. IPEAN agronomists were engaged as well in various agricultural experiments. These were carried out at the experimental station near the settlement chosen for this study, or in sample plots in different soil types as far away as 80 kilometers from their base. To do this, the station had a staff of five full time agronomists, several others who did internships throughout the year, and a host of helpers from the vicinity.

SESP and SUCAM[12] expanded their Altamira operations with the coming of the highway. SESP took over the Catholic Hospital of Altamira[13] and increased the number of its personnel and services. It trained nurses's aides for servicing the medical posts in the agrovilas, and was responsible for operating mobile medical care units that visited these communities on a periodic basis. SUCAM, active in controlling malaria-infected mosquitoes, saw its sphere of operation expanded, and their semi-annual sprayings of homes brought them to the farthest reaches of human penetration into the jungle. Road-building has damned up a large number of small streams which provides fertile breeding grounds for mosquito larvae. The expansion of malaria from the river banks to the terra firme is on the increase.

The food agency COBAL (Companhía Brasileira de Alimentos) established a store in Altamira and a number of subagencies in several agrovilas. It operated in consortium with CIBRAZEM (Companhía Brasileira de Armazenamento) whose responsibility it was to store the produce of colonists in the area. Part of this produce was sold in COBAL supermarkets, but most of the store stock consisted of processed and canned foods from southern Brazil. Though it was supposed to ease the burden of pioneers through lower prices, its stocks often lacked items of prime necessity. Its stock of fine liquors and luxury items was utilized more by government agents than by the homesteaders. The latter also had difficulty in paying with cash rather than buying on credit.

In the educational field, the Ministry of Education (MEC or Ministério da Educação e Cultura) and the State Department of Education (SEDUC or Secretaría de Educação) are most active. To encourage teachers to accept "hardship posts" in the Transamazon, the State Department of Education paid an added salary bonus. Nevertheless, the number of teachers who came from outside the project area was small. A major portion is made up of young females who came to the area with their pioneering parents, spouses, or relatives. Teaching positions in the secondary schools are available in Altamira and the agropolis. SESI (Serviço Social da Indústria) was active in running a vocational school, a technical and handicraft center, a sports program and other recreational facilities in Altamira.

The Bank of Brazil (Banco do Brasil) and the Bank of the Amazon (BASA or Banco da Amazônia S. A.) were encouraged by the government to finance the agricultural projects in the region. BASA mainly finances cattle operations of established fazendeiros. The Bank of Brazil, because of its role as the "national bank," has been given the injunction to provide loans at 7 percent to incoming pioneer farmers. Because of favorable markets in the South, financing is made available for planting rice, corn and beans only. Loans amount to Cr$50 per hectare for the above crops. Manioc and other root crops, even if cultivated on a commercial scale, are not encouraged through bank financing.

All these agencies and others of less significance work in the Altamira area. One would like to think that such a contingent could supply more than the needed services to a pioneer group. But the lack of coordinated action has led to overlapping spheres of activity, and in some cases, neglect of duty in order to avoid interagency confrontations over jurisdiction. Both ACAR and INCRA for example, have social workers. Separate files on every colonist were kept by each agency; separate visiting and separate informational meetings were held. A further problem is created because the majority of government functionaries come from southern Brazil and urban environments. Their schooling has afforded little opportunity for, an underplayed the value of, field work, even in the agronomic sciences. Urban Brazilians treasure the amenities of home, and are not attracted by the exotic nature of the hinterland. When confronted with the discomforts of the frontier, many such government workers hold fiercely to urban fashions, urban interests and practices, as a way of surviving, until they can be reassigned to a more civilized environment.

Ideal Settlement Scheme

The Program of National Integration that directed funds to Amazon development received the full support of the media and government agencies. Any information about the program, released by the federal government, was widely publicized and often embellished with patriotic overtones. The "building of a giant Brazil" became a national goal and not just a poetic dream. Agricultural agents approached individual farmers in their home states and painted rosy pictures of the Amazon area and its opportunities. Just as the region had previously been defamed by myths, nationalistic hopes now developed overly optimistic untruths. The colonists report that the promoters had promised "cotton balls the size of grapefruit,: and lands "as rich as those of Paraná." Not only was the scheme actively promoted, but a sophisticated land-use and community-planning blueprint was also developed.

An impressive modular approach to colonization was envisioned. The 20 kilometer small farming area along the highway was divided into rectangular lots with areas of 10,000 square meters each (100 hectares). The division of lots preceded any surveying or investigation of the physical environment before deciding its best use. Figure 3 represents the standardized pattern which was used throughout the Altamira Project. One-half of each rectangular lot was supposed to be left as uncleared forest. In this way, a forested strip of 2.5 kilometers in width would remain as a small natural reserve. Side roads or feeder roads would link the farm lands to the main highway. Along these secondary and main roads a variety of community types were planned.

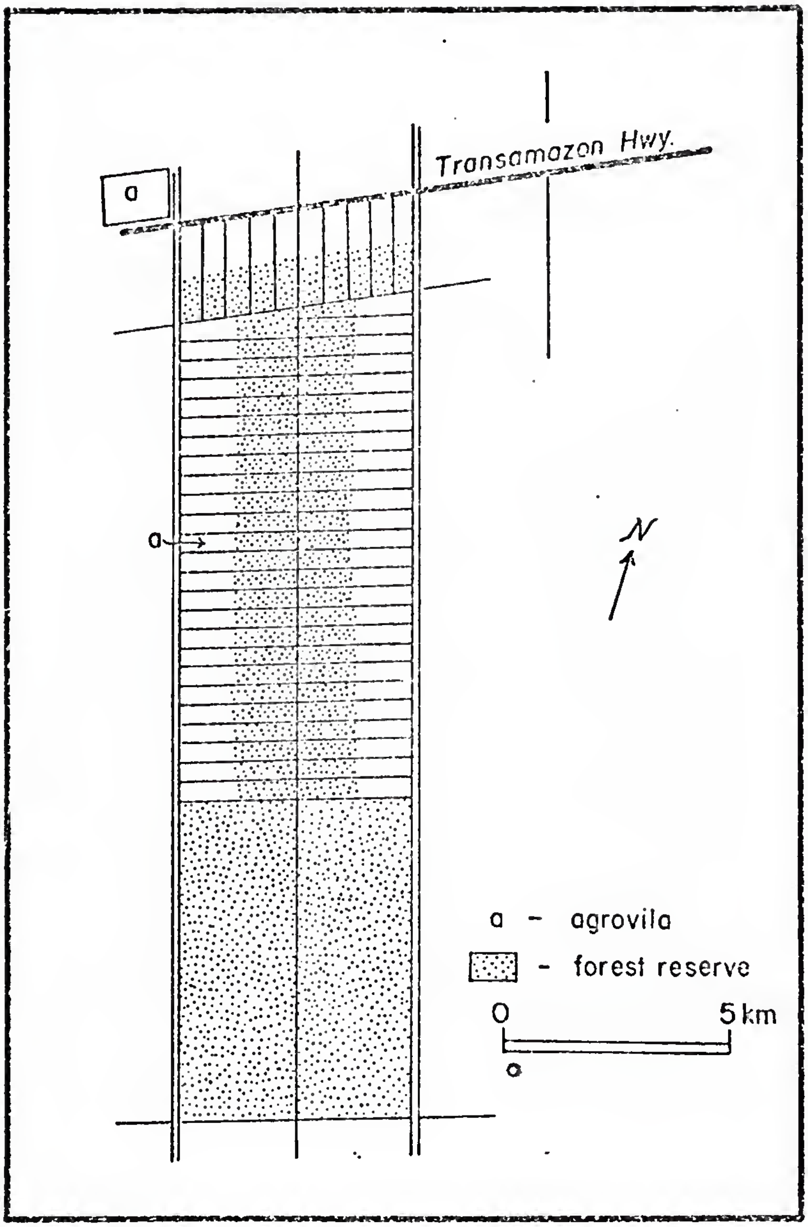

Figure 3. Arrangement of Lots Along Main Highway and Side Roads

Source: J. M. G. Kleinpenning. The Integration and Colonization of the Brazilian Portion of the Amazon Basin, p. 103.

Part of the modular scheme was the creation of planned communities at definite intervals, to serve the farmers in the area. The highway is designed to pass by traditional Amazonian towns and use these communities as supply centers for the planned communities (See Figure 4). Agrovilas, agropolis, and ruropolis are the names given the three types of nucleated settlements developed for the Transamazon. An agrovila is a planned village for approximately 48 to 60 colonist families, built both along the highway and on side roads. Ideally, the agrovila would be located along the main highway at 10 kilometer intervals, and at midpoint along the 15 or 20 kilometer side roads. Agrovilas provide basic services such as primary education, minor first aid, and, in some cases, a treated water source.

An agropolis corresponds to a planned settlement for approximately 300 families, including both colonists and government administrators. Each agropolis serves a maximum of 22 agrovilas with marketing, storage, and service facilities. Electricity, government administrative offices, large warehouses, restaurants, sawmills, and other small industries would add to the benefits of such a center. Even more elaborate is the ruropolis, a planned city of over 1,000 families to serve as "development pole." Rural industries, motels, and larger facilities for technical and economic matters are concentrated in the ruropolis. A ruropolis acts like an agropolis in the modular arrangement, servicing a number of agropolis in their radius of influence. One currently exists at the crossroads of the Transamazon and the Cuiabá-Santarem highways (See Figure 1).

The existing agropolis and ruropolis still have not taken their final forms, nor grown to their full size or roles. Agrovilas, on the other hand, began their function as nucleated settlements for colonists

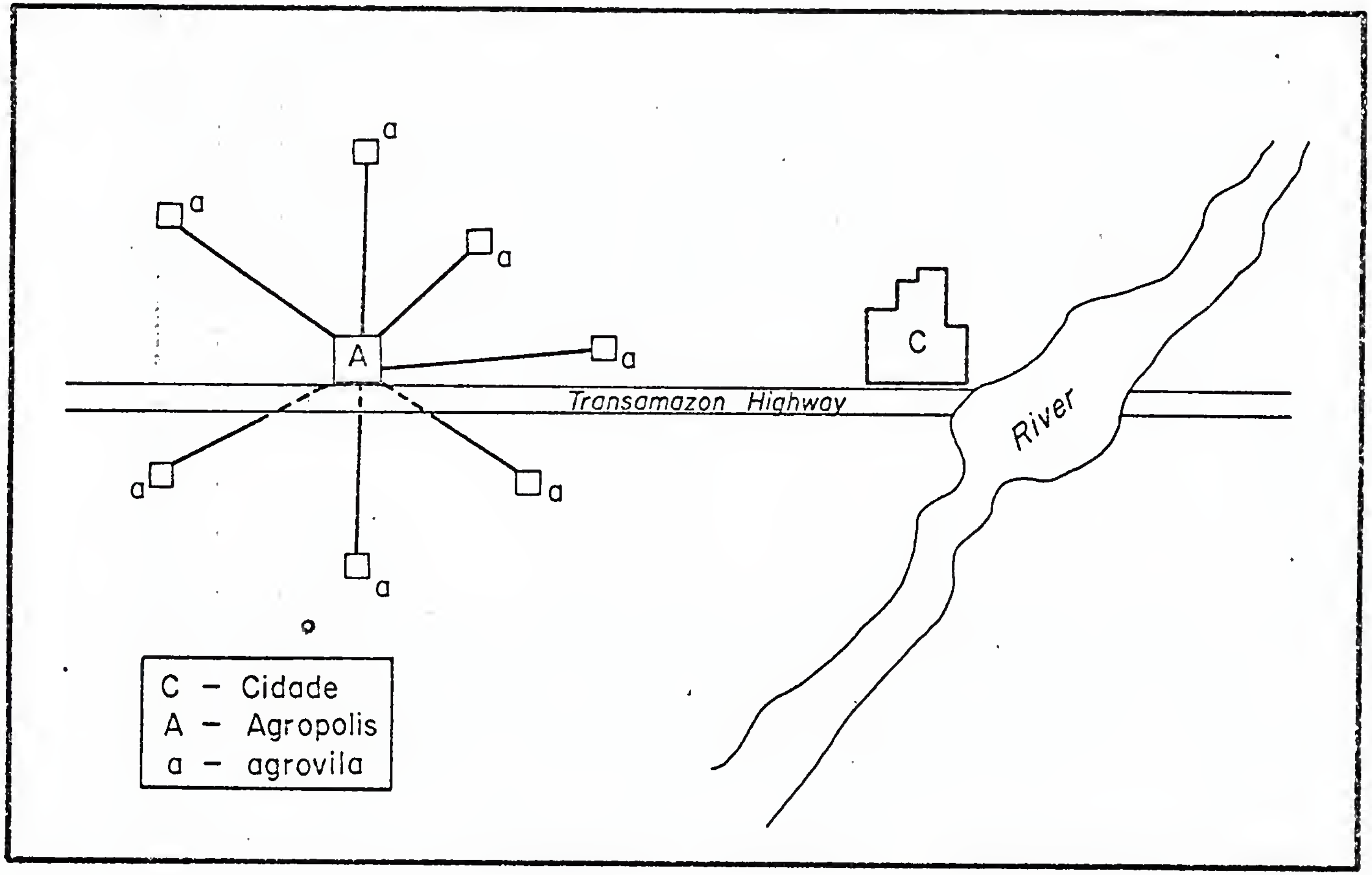

Figure 4. Modular Scheme of Transamazon Communities

in 1971. Since this study had as its purpose the evaluation of the colonists' adaptation to the Amazonian environment, under the conditions created by government planning, an agrovila seemed a proper focus of attention. At the time the study began, three population concentrations existed in the colonization project areas of Altamira, Itaituba, and Marabá. The Altamira Project was chosen for research because it was the largest of the three, and had received the greatest concentration of government effort during 1971-1974.

Within the Altamira Project a particular agrovila, hereafter called Vila Roxa,[14] was picked because it met a number of criteria which will be discussed in detail in the next chapter. It was one of the earliest communities created, and offered a variety of adaptive possibilities to its inhabitants. The agrovila concept is an interesting experimental approach to rural life created by Brazilian planners and has potential for use in other agricultural modernization schemes. By concentrating the rural population, planners believed the delivery of services could be both increased and improved.

NOTES

[1] Environmental determinists tend to imply, as does Price (1939: 181) that inferior tropical environments are inhabited by inferior peoples.

[2] British experts advocated sun helmets, spine pads, dark glasses, and dark houses as protection against the tropical sun. They advised the use of cholera belts and blankets to prevent chills and the use of starched shirts and collars to manifest racial superiority in inferior environments (Price, 1939:223).

[3] Price agrees that "hybridization may be dangerous between extreme racial types as those which so frequently make contact in the tropics" (Price, 1939:181).

[4] For data on this aspect see Chapter VI of this study.

[5] The La Chontalpa Project in Tabasco (Mexico) is even more regimented in this respect. Farmers are relocated in urban centers, and must follow the advice of the agronomists in charge. Thus, the farmer abdicates his power over production and management practices. This regimentation was imposed to insure returns on project costs, which were indeed high. But this is one case where the pace of colonization was too rapid, and there was not enough time to develop management practices, nor time to allow for the growth of regional urban centers to absorb the production (Nelson, 1973:80-84).

[6] The Alto Beni Project in Bolivia was another project which attempted to resettle farmers from the highlands in a lowland area. Poor selection of lands, poor timing of agricultural practices, naive advisors, and unrealistic repayment demands, have led many settlers to quit and to return to the highlands. Once home they discourage others from migrating to the new area (Nelson, 1973:86-93).

[7] Nelson (1973) and Dozier (1969) both review a number of Latin American colonization projects and the problems which repeatedly arise.

[8] The Brazilian government used the following values in estimating the available labor force: males equalled 1.0; adult females equalled 0.75; teenage boys equalled 0.50; and teenage girls equalled 0.35.

[9] The houses are a low-cost modification of an "ideal tropical house" developed through a SUDAM architectural competition, but modified to reduce its cost (Hasek, 1971).

[10] Their number, at the height of the boom in 1972, was 80. Their turnover during that year was 90 percent (Kleinpenning, 1975:125).

[11] ACAR was founded in 1947 in the state of Minas Gerais, in the Center West of Brazil, largely with funds from the American International Association of Economic and Social Development. Their services there met with success, and the organization can now be found in nearly every part of Brazil (Wharton Jr., 1968:391).

[12] SESP (Serviço Especial de Saúde Pública) was founded during World War II and has had a major impact in the control of communicable diseases and the availability of health services in the Amazon. SUCAM (Superintendência do Contrôle da Malária) has as its major tasks the control of malaria and making anti-malarial pills available.

[13] The Hospital was founded by Bishop Dom Clemente and remained a relatively small unit until the arrival of the Transamazon and SESP.

[14] Vila Roxa is a fictitious name. It roughly translates as "Redville" because of the red clay soils on which it is located.

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CHAPTER II

THE STUDY OF A PLANNED COMMUNITY

Choosing a Study Site

It is traditional in anthropology to choose a small community in which to research various aspects of a culture. The choice of a Transamazon planned village, however, was based not solely on traditional concerns, but also on the interesting problem presented by a government-directed homesteading scheme. It is opportune both for the research and the region that the Brazilian government should have spearheaded its penetration of the Amazon Basin with a small farming sector. For one thing, it is this sector which historically has opened new lands for agricultural use. It is also this sector which is increasingly being looked to for the solution of the world food crisis, since the twenty year effort to improve the commercial sector has delayed but not solved, the growing gap between food production and population growth (USDA, 1970:20). Lastly, it is in this sector that one generally finds the most difficulty in changing traditional patterns, since the survival of the farm family rather than simple profit is at stake. Residing in the nucleated settlement of Vila Roxa allowed us day to day contact with a large group of colonists who had come to this small farm sector of the Transamazon Project.

Vila Roxa lies midway between the traditional town of Altamira and the planned agropolis, "New Brazil." It offers most of the things that were important to the study. As shown by Table 2, people came from all areas of Brazil, including eleven different states that represented North, Northeast, South and Center-West regions (See Figure 5).[1] They have been in the Altamira region as long as the colonization project has existed, and have experienced both the confusion of the early days and the more stable present. The farmers are located in an area which offers a variety of economic options such as their own agricultural work, wage labor at the experimental station, market dealings in either Altamira or "New Brazil," and various economic interactions with the native population.

Vila Roxa is situated on a relatively high knoll[2] that dips sharply in the middle to form a small "valley." It derives its fictitious name from its bright red clay soils--similar to "Georgia clay" in the United States. Unlike some other agrovilas, it has no stream.[3] The large area in the middle is cleared of its original vegetation, and some portions are now planted in castor beans, black pepper, and a few papaya trees. In a number of communities, especially those situated away from the main artery of the Transamazonian Highway, the forest cover has not been cleared, and vegetation has encroached upon the houses. In Vila Roxa, the forest now lies at a distance, and the mayor and his fellow inhabitants feel that theirs is the most attractive community in the area.

TABLE 2

STATE AND REGION OF ORIGIN OF VILA ROXA RESIDENTS

Region	State	Number of Residents	Percentage of Population
Northeast (16)	Bahía	1	2%
	Ceará	2	4%
	Paraíba	1	2%
	Pernambuco	1	2%
	Piauí	1	2%
	Rio Grande do Norte	10	20%
North (7)	Maranhão	1	2%
	Pará	6	12%
Center-West (8)	Minas Gerais	7	14%
	Goiás	1	2%
South (19)	Paraná	19	38%
		50	100%

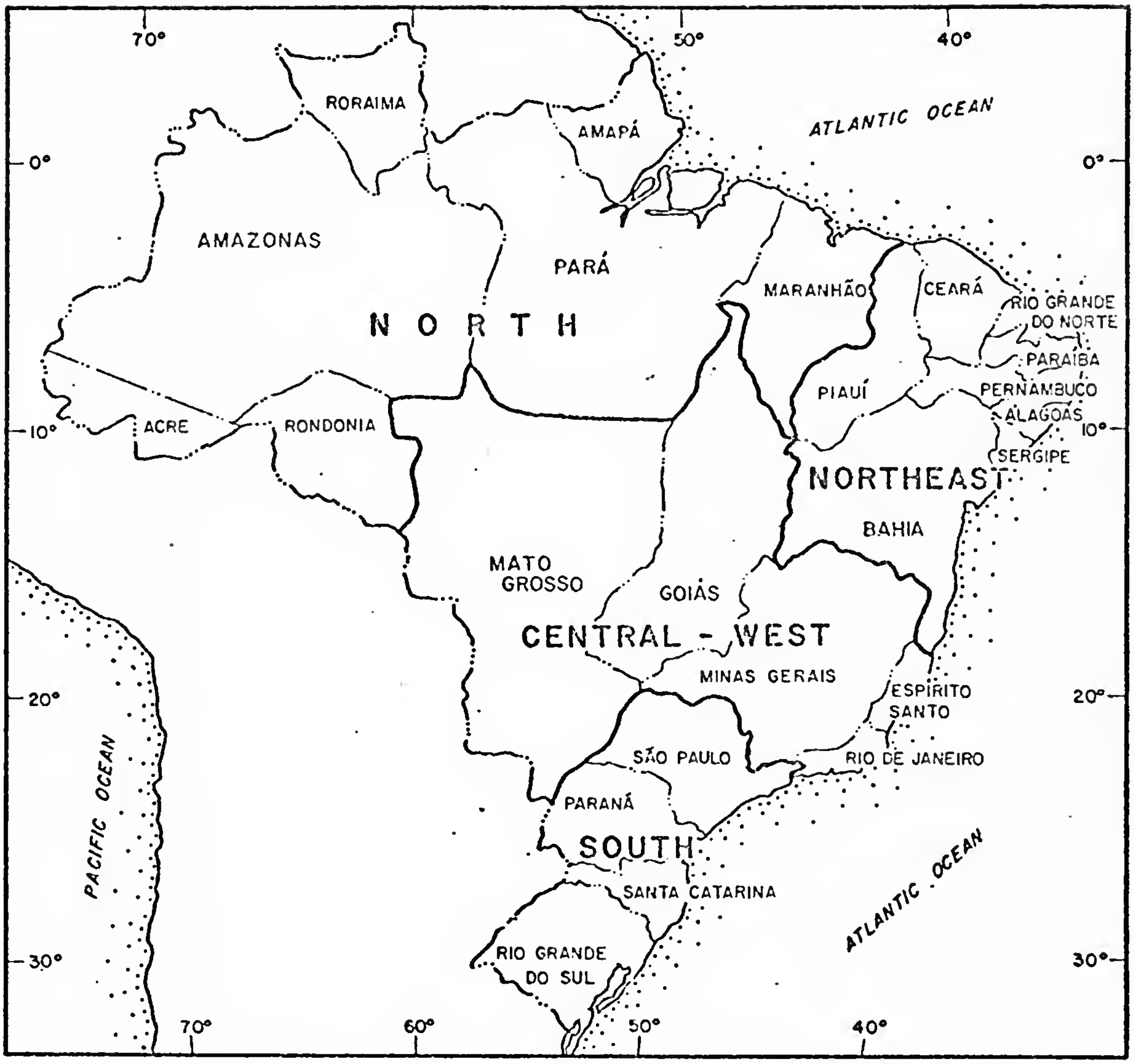


Figure 5. States and Regions of Brazil

Like other planned villages along the main highway, Vila Roxa has 48 standardized houses which are occupied by the pioneer families and one nurse's aide. The actual number of colonist homes may vary from 48 to 60 depending on whether there are three or four streets. The houses in Vila Roxa are always full, and the mayor is kept busy juggling requests from new settlers for housing. While ideally other agrovilas should be located half-way down each transecting side road, there is one side road near Vila Roxa where the terrain and large areas of poor soil makes such an investment unfeasible. The colonists in this section are allowed to live in Vila Roxa until further arrangements can be made. The mayor and the nurse's aide in Vila Roxa cater to the needs of four other side road villages. Each INCRA mayor and resident SESP nurse's aide usually are situated in the agrovilas along the highway. The mayor of Vila Roxa village however, lives 200 meters away in an unplanned settlement which serves as a temporary shelter for incoming settlers.

In the village there is a primary school, a medical post, a water tower, a small warehouse, the mayor's office, and a colonist owned front-room store. The U-shaped settlement looks out to the highway (See Figure 6). Three colonists' houses along the road have been included in the "community," since they functionally belong to Vila Roxa due to the physical and social closeness between these families and the village. The dynamic processes of social life are discussed in Chapter VIII.

The population of Vila Roxa, at the time the age-sex pyramid was drawn, was made up of 331 persons (See Figure 7). The selection criteria used by the government is reflected in the population structure. The population is young; almost 70 percent are under the age of 20, and

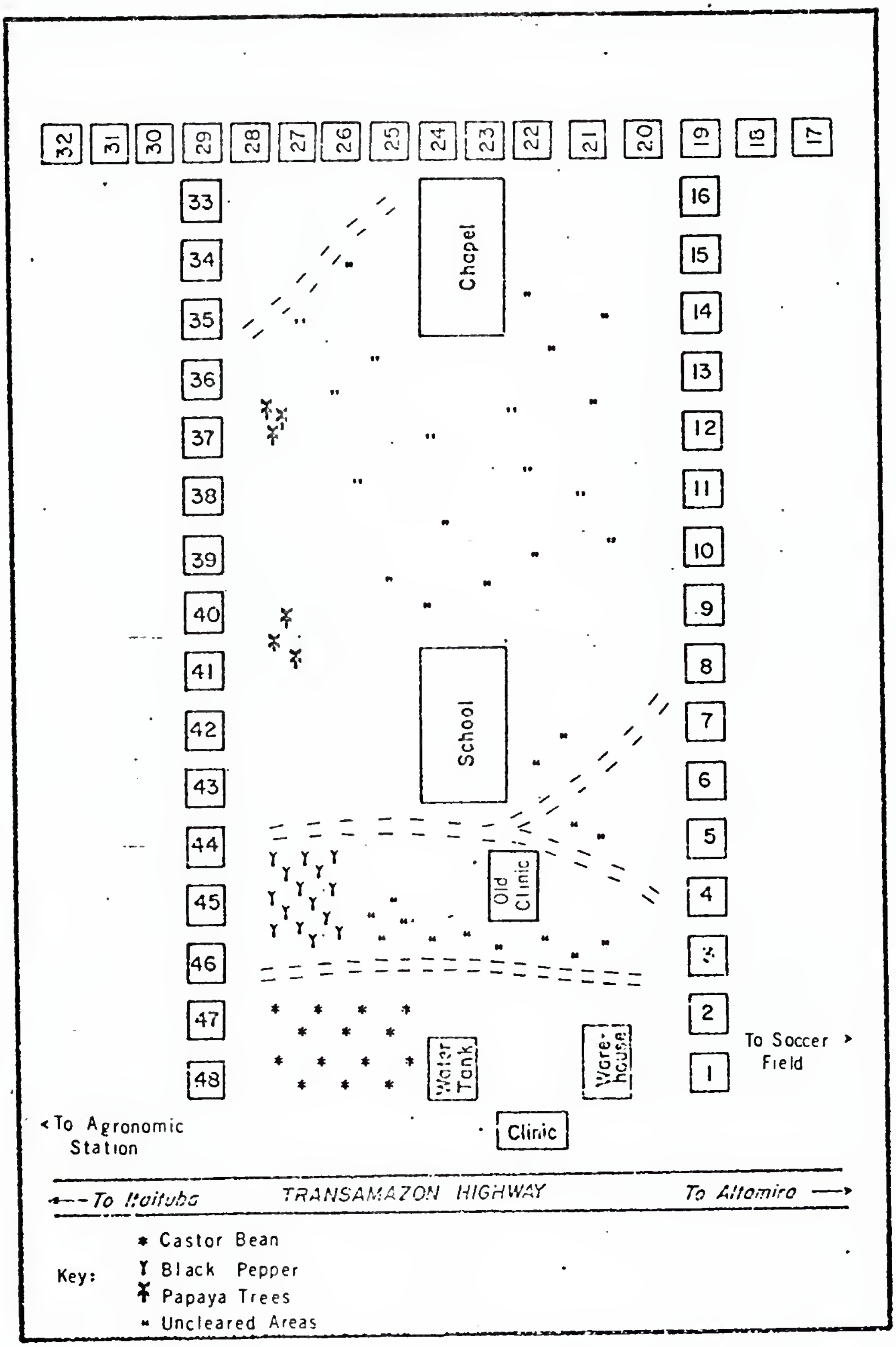


Figure 6. Schematic Drawing of Vila Roxa

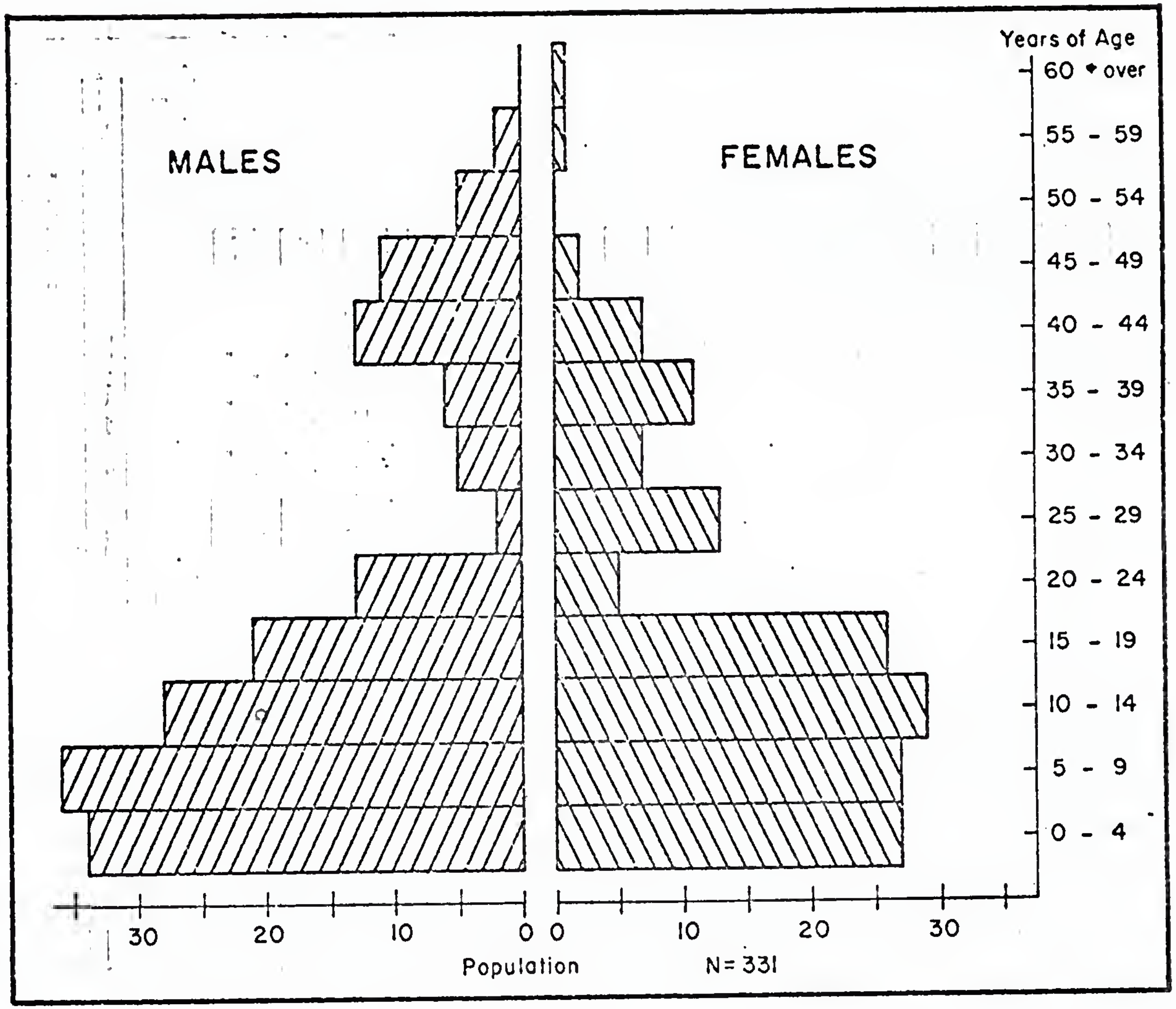


Figure 7. Vila Roxa Age-Sex Pyramid

Note: The mean size of the households is 6.22.

only 2.4 percent are over the age of 50. Large families were favored in the colonists' selection, consequently, most farmers were concentrated in the 40 to 49 year old groups. Adult females are younger--reflecting the preference among the male population for spouses seven to nine years younger than themselves. Since nearly 55 percent of the population is under the age of 15, this large dependent population places costly demands on the 28 percent who produce and distribute food in the village. Vila Roxa's population is even younger than that of Chichipate (Carter, 1969:11-12) and Tasbaupani (Nietschmann, 1973:49-51), both of which have been described as young.

At first glance, the agrovila presents a picture of total conformity. Each agrovila house is divided into five rooms, a front porch, a living room, a dining room, two bedrooms and a kitchen. While ideally all government-built houses are to be kept freshly painted and free of any unauthorized additions, this rule was often unenforced in the side road agrovilas. Here wattle-and-daub kitchens, thatch laundry areas, and animal pens have appeared. Even in Vila Roxa residents are slowly beginning to construct such outbuildings behind their houses despite the fact that the community serves as a showplace to visiting dignitaries.

When hammocks are used in the homes, any room may be used for sleeping, since the hammocks can be rolled up each morning and hung on a wallhook. Only where people sleep in beds can the bedrooms be easily defined. A small bathing or storage area is located next to the kitchen. An outhouse, 25 meters behind the house, is also provided. Like the house, it is a clapboard structure with a roof of corrugated composite material (brasilit). The houses are well-ventilated and relatively free of insects. Roaches, spiders, flies and mosquitoes are present but do not seem to constitute a serious health threat. This is not the case, however, with rats which are abundant and bothersome.[4] Scorpions and snakes have rarely been seen near the houses, and no one recalls having been bitten by either around their homes.[5]

Vila Roxa houses are raised off the ground by stilts, their height depending on the inclination of the ground's surface. The area underneath the house is used as a playground by the children, a storage place for wood and tools, and sometimes as a chicken coop. While some 92 percent of the families own chickens, few chickens are kept penned during the day; rather, they are allowed to glean their existence from the meager table scraps and peelings thrown away by the housewives. Pigs, on the other hand, were prohibited for a while by the nurse's aide. Gradually they are being brought in from the distant lots, because of the difficulty of feeding them regularly. There is also the danger of losing them to untrustworthy lot neighbors or jungle "cats"--ocelots, jaguars and other predators.

Around the houses people plant fruit trees, vegetable gardens, manioc and other tuber plants, flowers, and medicinal herbs. During the first years, some colonists were reluctant to start gardens, since they intended someday to settle on their own lots. There is an ambivalent feeling towards living in the agrovila. Most farmers understood the government to have "promised" a house on each individual lot, where the majority of colonists would prefer to be. The value of even services such as the school and the health post have "declined" in the view of the colonists and no longer act as incentives to stay. Since the houses are government-built and not yet paid for, the colonists are reluctant to invest the time and fencing materials required for a garden, in a house "which isn't theirs." Each person has a right to a back yard of 80 by 20 meters, but few had cleared such an area when we first arrived at the village in October 1973. By the time we left in October 1974, more than eight families were making use of this area for gardening, and others were planning to do likewise.

An "interdenominational" church was constructed in Vila Roxa, as in other agrovilas, to serve the purposes of religious worship and community meetings. However, this building is mainly used by the Roman Catholics. Three Pentecostal sects are represented in the community, but all three conduct their worship in private homes. Visiting Presbyterian ministers use the interdenominational church for community services and the Catholic priest was heard to encourage Catholic children to attend the one week Bible course taught by a young Presbyterian lady. Such "historical" Protestant Churches (Willems, 1967) in general, have more ecumenical dealings with Catholics than do the more aggressive and fundamentalist Pentecostal denominations. Each Pentecostal sect has a resident pastor in whose home services are commonly held. The interdenominational building is referred to, therefore, as the (Catholic) "Church," by all the colonists.

A small two-room medical post is staffed by a resident nurse's aide from the Public Health Service (SESP). Such aides are usually young local women who receive a short training course in first aid. A

Volkswagen micro-bus comes weekly with a physician to take care of the more serious problems and take blood, urine, and feces samples to Altamira for analysis. A new medical post was under construction during our stay in Vila Roxa and was inaugurated a week before we left. It will primarily serve as a two-bed maternity ward attended by a midwife, serving expectant mothers awaiting an ambulance into town. A SESP ambulance driver also lives in Vila Roxa.

No one in Vila Roxa owns his own motor vehicle, but a colonist who lives near the village owns a pick-up truck. This vehicle is mainly used to supply his front-room store, but also transports many expectant mothers to the hospital in Altamira. Only a small number of settlers have horses or mules. Private micro-buses travel up and down the highway and serve as the public transportation system. For the 23 kilometer trip to either Altamira or "New Brazil" the charge is Cr$5 (US$.70) per person each way. The price soon doubled after the oil crisis began. The buses start their runs at about six a.m. and end at about six p.m. when the last leave Altamira for "New Brazil," where most of the micro-bus owners live. A couple of other micro-buses reach agrovilas further up the highway, but this service is available only every two to three days, and the cost is now up to US$20 each way. Regular bus service is available during the summer months at lower cost, but there are only two runs daily.

As a cross-check on the representativeness of the community, a scaling approach, using a schedule, was employed to rate 21 communities in the area. This included nine agrovilas along the highway, six agrovilas on side roads, three agropolis, one ruropolis, and two traditional towns. They were rated on a 100-point scale from most to least socioeconomically developed, using material features as indicators of such development.[6] Through both personal knowledge and the interviewing of a group of community residents to stimulate mutual correction on public information, the presence of items and institutions was noted. The maximum score was allotted to Belem, the largest urban center in the Amazon. The schedule was fine-tuned to deal with the highway communities but was flexible enough to be applied in two traditional riverine towns for the purpose of contrast. The agrovila chosen for study rated 42 points, which places it at nearly the midpoint position in the scale of complexity. Figure 8 indicates the fluctuations in score. For the communities in the Transamazon Highway, the advantage of being along the main artery is evident in the scores. Side roads communities have much less access to services and facilities. Some of these agrovilas are even being abandoned by their inhabitants.

Research Methods

Though research was concentrated in Vila Roxa, other villages and towns were visited at various times. Comparative data on villages at different points along the highway, on side roads, and on larger towns was obtained. Individual farmsteads along the road were also visited. We arrived in late 1973 by a pick-up truck which had survived the rough distances between Belem and Altamira. This trip was helpful in that it gave us a different view of the highway and landscape changes. As we went through Marabá, another project area along the Tocantins River, the effects of long-term occupation and the serious problems of malaria in that strip were evident. Only two agrovilas were in existence in the 500 kilometer stretch between Marabá and Altamira, both near the two respective towns. The road from Marabá to Altamira was not passable

CITIES

A. Belem

B. Paragominas

C. Itaituba

D. Altamira

PLANNED COMMUNITIES ALONG THE MAIN HIGHWAY

E. Agropolis New Brazil

F. Ruropolis

G. Agrovila Côco Chato

H. Agrovila Leonardo da Vinci

I. Agrovila Vila Roxa

J. Agrovila Penna Filho

K. Agrovila New Brazil

L. Agrovila Boa Esperança

M. Agrovila Jorge Bueno

N. Agrovila Nova Fronteira

O. Agrovila Abraham Lincoln

PLANNED COMMUNITIES ON SIDE ROADS

P. Agrovila Duque de Caxías

Q. Agrovila Getúlio Vargas

R. Agrovila Novo Paraíso

S. Agrovila Princesa do Xingú

T. Agrovila do travessão 3-5

U. Agrovila Segunda do travessão 3-5

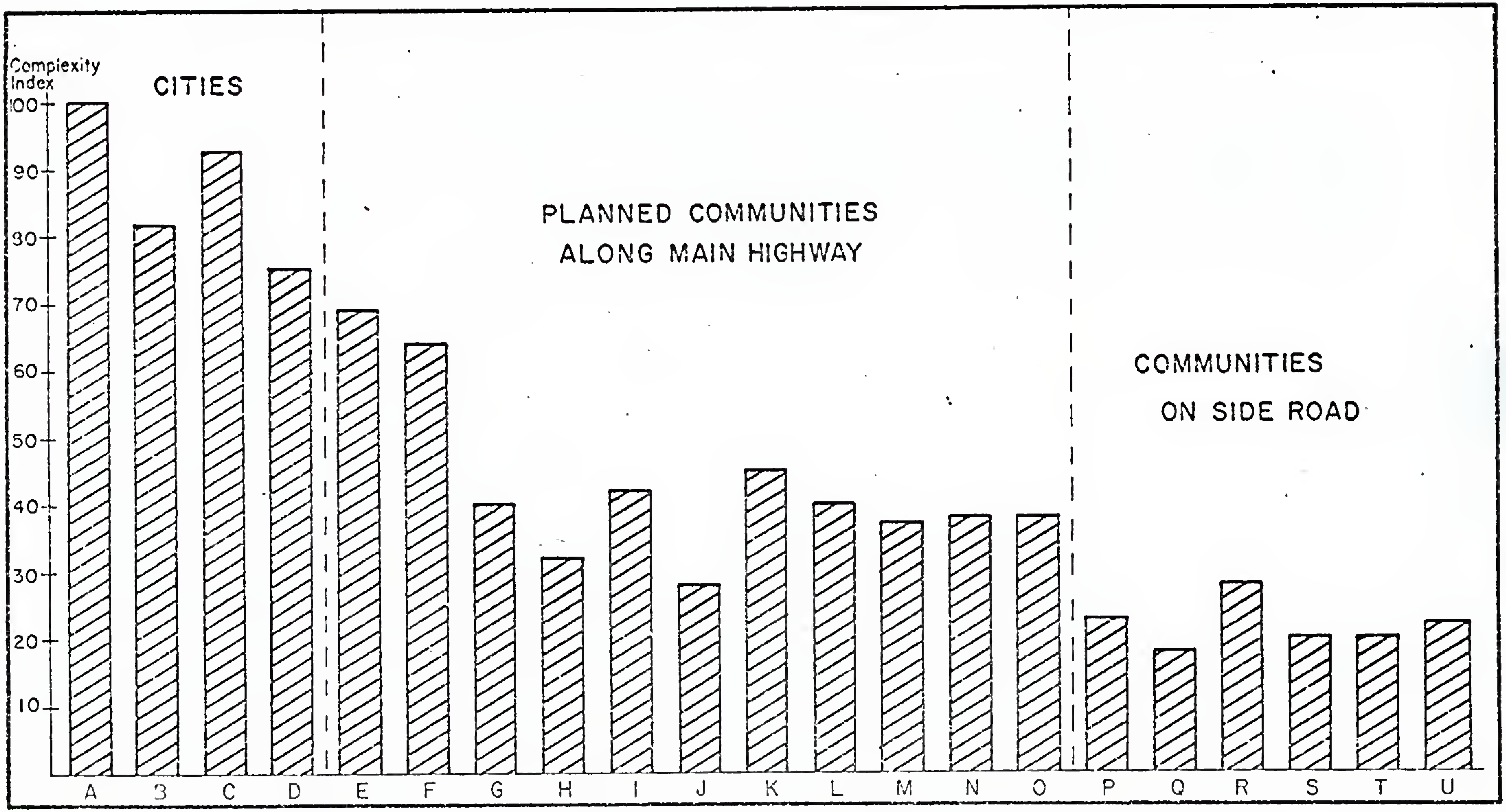


Figure 8. Index of Community Development in 21 Amazonian Communities

during several months of the rainy season due to flooding in Marabá and the washing away of bridges. Supplies and people could move in and out of Altamira only by plane or by boat during the rains, a return in fact to the traditional transportation system of the Amazon.

Through the intercession of the director of IPEAN, a house was granted us by the director of INCRA in Vila Roxa. The house had been vacant for six months and was located at a high point from which a large portion of the village was visible. Field notes were kept by myself and my wife, Millicent Fleming-Moran, who also carried on research on complementary aspects of social organization and health.

Informal open-ended interviewing constituted a significant portion of our activity in the first months of research. During this rainy period we concentrated on gathering the history of the settlement, and the experiences of numerous families. We were fortunate that our house was located next to the only front-room store in Vila Roxa. The store also served as a main gathering place in the village. Social groupings and economic activity could be easily observed from our vantage point and we could always go over to buy a little something and get involved in the group's conversation.

Having once established rapport as neighbors, we had ample time to explain why we were in the community, and more formal research was undertaken. Data on cropping techniques, agricultural inputs and outputs, soil sampling,[7] credit, and economic exchanges, were collected, and the pre-testing of a farm management schedule began. Collections of secondary-succession plants and medicinal herbs were also made. Their identification was facilitated by Dr. Paulo Calvacante of the Museo Goeldi in Belem. Maps were obtained from the topography division of INCRA, and photographs were taken to document social and technical activities.

An extensive farm management survey was developed based on a publication from the Food and Agriculture Organization (Yang, 1965). Added to this essentially economic survey were questions regarding child-raising, health and nutritional status, education and migration history. Appendix 3 includes a copy of the interview schedule utilized. Two sample populations were used. First, a 50 percent sample of Vila Roxa residents was collected and represents the existing factions of Catholics and Protestants, and the areas of origin of the farmers. Then, as a way of checking the representativeness of Vila Roxa residents, vis-a-vis the situation of other farmers in the Transamazon, interviews were made at other points along the highway and transecting side roads.

In the summer we were joined by a group of graduate students from the University of Florida's Tropical South America Fellowship Program. Some stayed in Altamira, others in two traditional Amazon riverine towns, and still others resided with us in Vila Roxa. While we administered the Vila Roxa survey, the larger sample required more interviews, and the summer students helped in administering the farm management survey. Two Brazilian students also aided in this effort as part of a cooperative arrangement made with the Federal University of Pará in Belem.

The area covered was 108 kilometers along the main highway from 18 kilometers east of Altamira to kilometer 90 west of the city, and as deep as 20 kilometers on various side roads. The sample used for this broader survey could not be stratified with the preciseness of that used in Vila Roxa. The village was intimately known to the researchers who could, after nine months, choose the most appropriate stratification criteria. The only reliable data available on the other colonists was their area of origin. The INCRA files on each colonist were studied to arrive at the proportions of farmers which came from each state and region.[8] Using this proportional criteria, a similarly proportioned sample of 101 colonists was drawn up for the area of highest colonist concentration. In interviewing, an attempt was made to include farmers under all possible conditions: living in agrovilas along the highway; in agrovilas far into side roads; in individual homesteads along the highway and the side roads; near Altamira and far from it. Such a variety of situations aimed at exploring both the possible relationship of location to success, and to represent all types of possible situations in which farmers found themselves.

Frequently, the interviewer would take along soils research equipment[9] in order to collect soil samples in the areas cultivated by Vila Roxa farmers. In these cases, the researcher remained all day with a farmer so as to verify the answers provided in the survey[10] and explore other aspects of farm management. These lengthier management studies, carried out by field measurements, testing, observation, as well as formal interviewing, gave added assurance that the farmers were knowledgeable, reasonably accurate in their figures, and frank.[11]

Migration histories were obtained informally, as well as by formal interview. A map of Brazil hung on the wall of our house, covered with a plastic sheet. When local families came to visit they took delight in using crayons to mark the various places where they had lived, and recalled how life was in each of these places. In general, this provided a good outline of their life histories. Such questions were also included in our farm management schedules and asked of those who had not given us such data already.

To a large extent, research activities must keep balance with what is happening in the community. Thus, when the men are home during the rainy season, one must obtain data which is best gotten through memory-recall. Such data, when the farmers are working in the field, tend to get short treatment. While they are in the field, it is best to stay out of the way and observe, do time-and-motion measurements, map the crop-distribution in the fields, keep notes on storage methods, and other behavioral aspects. On first visit, it is almost inevitable to avoid "special treatment" or attention, but the next time the farmer usually ignores the researcher's presence and goes about his work as usual. Shared meals are also "normal" in subsequent visits.

In all, nearly one year was spent researching Vila Roxa and its inhabitants. Trips were taken to Belem, Brasilia, and Manaus in an attempt to gain agronomic, governmental, and ecological data on the region. Interviews were held not only with the colonists themselves but also a wide variety of INCRA personnel, medical professionals, agronomists, bureaucrats, and scientists. The Transamazon project is still a topic of interest and controversy. In the following chapters we will discuss the area of the Altamira project and how the colonists are adapting to this new environment. It is here where we will attempt to focus on these areas of such intense interest and controversy.

NOTES

[1] The North Region: Pará, Amazonas, Acre, Roraima, and Maranhão. The last state, which is usually classified as Northeastern, is placed in the Northern category because many of the colonists emigrated from the Amazonian portion of this state.

Northeast: Rio grande do Norte, Sergipe, Piauí, Ceará, Pernambuco, Paraíba, Alagóas, and Bahía.

South: São Paulo, Paraná, Santa Catarina, and Rio Grande do Sul.

Center-West: Minas Gerais, Mato Grosso, Góias, Rio de Janeiro, Espírito Santo, and Distrito Federal.

[2] About 100 meters above sea level.

[3] Two streams are near the village, both about one kilometer away. Before the water tower was completed in April 1973, women would go to either stream to wash clothes or fetch water.

[4] To date the only household rat identified in Altamira agrovilas is the black rat (*Rattus rattus*).

[5] Only one case of snakebite was recorded during the year of study; this took place in the uncut brush between the agrovila and the temporary colonist shelter down the road.

[6] This scaling schedule is a modified version similar to the one used by Cornell Researchers in Peru (Doughty *et al.*, 1966). See Appendix 2 for the items used in scaling.

[7] Both fertility cores (0 to 10 centimeters) and complete profiles (0 to 180 centimeters) were taken.

[8] The sample was stratified proportionally according to both states and regions outlined earlier. For instance, since 36 percent of the colonists had migrated from the North Region, 36 persons in the 101 sample were Northerners. 25 percent from Pará, 10 percent from Maranhão, and 1 percent from other North states made up the state proportions. This arrangement was convenient in three cases where the investigator

could not locate three persons from rarely represented states, as for example in the 1 percent from other North states. In those three cases substitutes from neighboring states in the same region of Brazil were interviewed.

[9] An Eyelkamp bi-partite soil auger, a Hoffer soil sampler for fertility cores, a Heilege-Truog pH testing kit, and a soil thermometer were regularly taken to the field. A spring balance and metric measuring tape were also carried to verify weights and measures given.

[10] The formal interview was carried on both before and, more commonly, after the farmstead had been observed, soils collected, and other activities (e.g., observation of threshing or cutting rice) observed.

[11] In the surveys outside Vila Roxa, reasonable doubt can be cast on farmers' hunting habits; however, since there was a general prohibition on hunting, respondents may have feared answering openly. A more accurate picture of these activities could be obtained in Vila Roxa where farmers knew us well, and such knowledge was commonly exchanged.

CHAPTER III

INROADS INTO THE LAND

The Tropical Rain Forest

The land to which the Transamazon pioneers have come is variously referred to as "the tropical rain forest," "jungle" or, more accurately, "tropical moist forest" (Holdridge, 1967:17). The climate of Altamira is classified as "Aw" according to Koppen's system, that is, it has a tropical climate with monthly temperatures always above 18° C, and a marked dry season (Falesi, 1972). The average annual temperature is 25.9° C, and exhibits a mere 1.4° C in annual variation (See Figure 9), while there may be a daily variation of as much as 10° C. The month of heaviest rainfall is March, while the driest period occurs between August and September (See Figures 14 and 15 in Chapter V). Agriculture in regions such as this has been largely characterized by shifting cultivation. Shifting cultivation is "any continuing agricultural system in which impermanent clearings are cropped for shorter periods in years than they are fallowed" (Conklin, 1963:1). This is a widely diffused form of subsistence agriculture practiced by over 200 million people in over 36 million square kilometers of the globe (Nye and Greenland, 1960:v).

It is a widely held misconception that shifting cultivation is practiced only by simple cultures living in isolation (Kellogg, 1959:35). Furthermore, Spencer (1966:2) rightly points out that the system itself should not be viewed as simple. Perhaps it would be more accurate to view it as an assemblage of techniques, followed by those for whom it

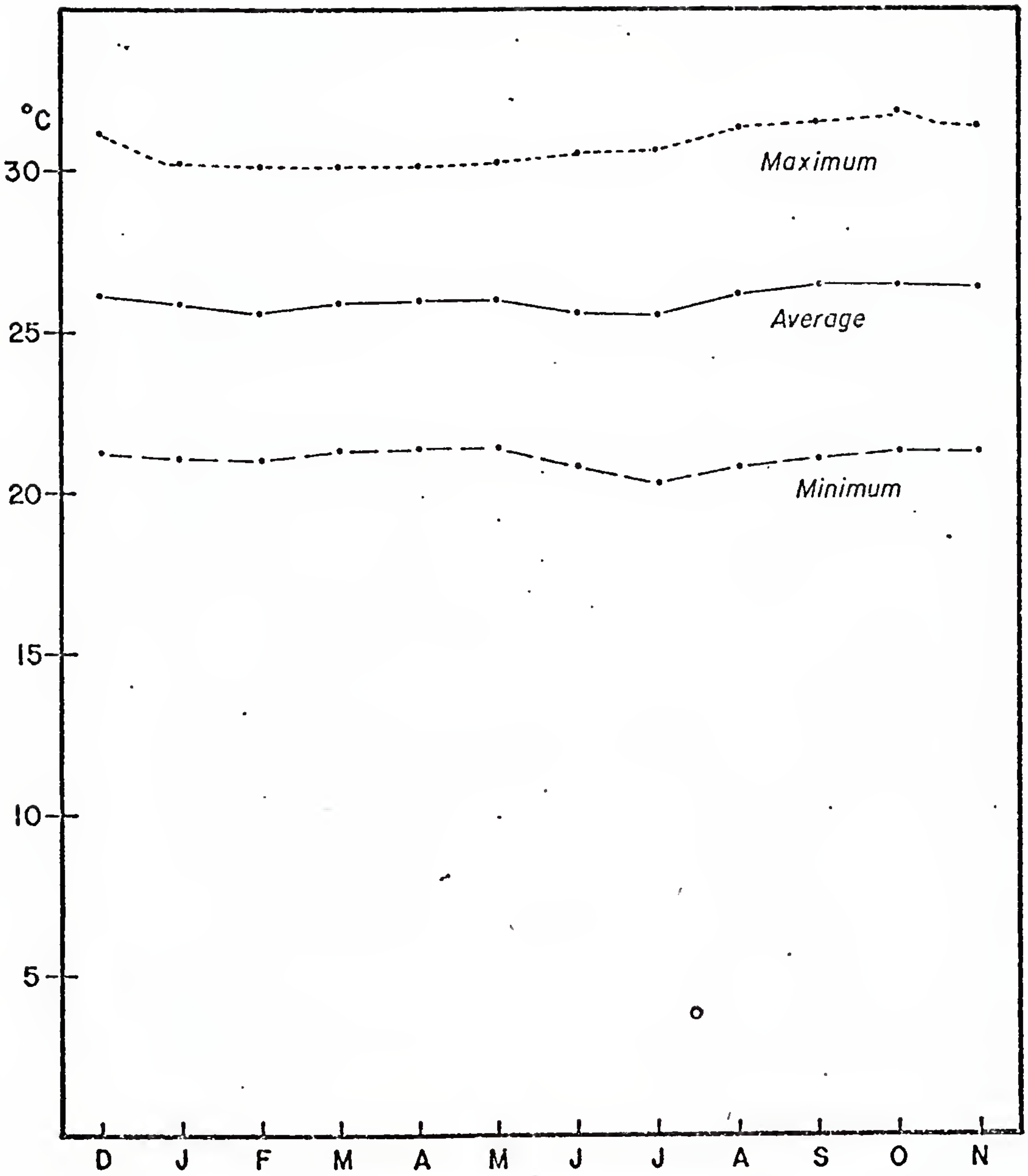


Figure 9. Average Altamira Temperatures (1931-1967)

Source: Italo Claudio Falesi. Solos da Rodovía Transamazônica, p. 9.

is a practical procedure. Shifting cultivation is practiced by peoples of every race and level of culture. It probably was the earliest method used by agriculturalists in forested regions, especially in the tropics (Spencer, 1966:2). In shifting cultivation, farmers may shift not only their fields but also their own homes. For example, the Ashanti of Ghana remain in a permanent settlement and rotate their fields, while the Boro of the Amazon move both their residences and their fields (Nye and Greenland, 1960:5-6). Shifting cultivation will be identified here as a pioneering system utilized by a people who lack capital resources and economic privilege. Political and economic conditions have been known repeatedly to pressure these frontiersmen to move about continually in search of farm work. Population pressure in the cities, land expropriation by ranchers, and the drive to intensify current agricultural enterprises promote such migration of small farmers to uncleared forest areas.

Tropical rain forests form a belt around the globe, with most of the area lying to the north of the equator. The largest uninterrupted mass of rain forest is found in the Amazon Basin (Richards, 1964:11). Gourou (1966) points out that, worldwide, population levels barely reach one person per square kilometer in tropical forest areas. In some areas of Africa and Asia it reaches 20 persons per square kilometer. Spencer (1966) feels that this is the "ceiling" for population which can be supported by subsistence systems presently used in the tropical areas. Many ecologists favor shifting cultivation over intensive agriculture since the former is less likely to have a permanent effect on the biome.[1]

The Amazon Basin is divided into two macro-ecological zones: the _terra firme_ and the _várzea_. Terra firme occupies about 98 percent of the area and consists of all land not subject to seasonal floodings (Meggers, 1974:93). The Transamazon Highway was constructed entirely on this higher land.[2] Tree forms predominate in the plant species to be found in the tropical rain and moist forests. Even the profusion of climbing plants and some epiphytes have woody, tree-like trunks (Richards, 1964:2). While to the uninitiated the tropical forest appears as a uniform mass of a few species, its complexity is truly staggering when compared to that found in a temperate environment. The luxurious variety of the flora has often been seen as a limiting factor for lumber exploitation, since few trees of any one species are found in a given area, and trunk diameters are rarely impressive (Kleinpenning, 1975:15). The tallest trees are shallow rooted and have swollen bases or flying buttresses. Undergrowth is usually limited and there is a noticeable absence of weeds, grasses and shrubs, except where a tree has rotted, and sunlight reaches the ground. The forests of the Altamira region, however, are liana forests, where walking is slow and difficult due to entangling vines.

Soils under tropical rain forests have long been thought to be greatly weathered and highly leached, with acid pH, few exchangeable bases, low nutrient levels, and inherently low fertility (National Academy of Sciences, 1972:1, 45). Such oversimplification of the soil situation has too frequently been accepted without further qualifications. In the last two decades, however, there has been renewed interest in the true status of tropical soils.

Aside from the lack of significant variation between the mean summer and winter temperatures, the conditions responsible for soil formation are as diverse in the tropics as they are in temperate areas. Even the parent rock materials and weathering conditions are very much like those in forested areas of the non-glaciated temperate zone. Agriculture in the tropics first developed in areas of high base status soils, which constitute 18 percent of all tropical soils.[3] These soils present little or no problem with overacidity. Nitrogen or phosphorus are sometimes lacking, but correction is not costly. A larger area, 51 percent of tropical soils, is made up of low base status soils, which usually are highly leached, acid, and present great problems with aluminum toxicity. They can be intensively cultivated though with manures and fertilizers, as in the Southeastern United States and China. Such soils can be managed, especially if plants that are well-adapted to low base status soils are chosen. Examples of such plants might include manioc, sweet potatoes, cowpeas, upland rice, and a number of grass and pasture legumes (Sánchez and Buol, 1975:598-603). Since there is great variability in tropical soils, most of the problems encountered will require site-specific solutions.

Amazon soils include a variety of pedogenetic types such as latosols (yellow, red, and dark red), distrophic and eutrophic lateritic soils, distrophic and eutrophic red-yellow podzols, sandy quartoze soils, terra preta, groundwater laterite, humic gleys, and organic soils (Falesi, 1974:202). Várzea soils, seasonally enriched by alluvial deposition, have excellent agricultural potential. Their utilization calls for massive investment to manage the seasonal floods and poor drainage. The soils of terra firme, on the other hand, are generally well-drained, porous, deep, of variable structure, and have low to above average fertility. Widely scattered pockets of high base status soils and anthropogenic organic soils exist throughout the terra firme. Latosols, the predominant soil type, can be farmed intensively by either using fertilizers or by careful selection of cultigens that are adapted to the area conditions. The pockets of high base status soils can and should be intensively used. It was in one such area that the first lands distributed by the Altamira Project were located.

The Altamira region is composed largely of soils originating from chemically basic rocks (IPEAN, 1967:7). The area rests on a low plateau which dates from the Tertiary and Quaternary periods. The undulating relief of the land shows a predominance of latosols and podzols at the high points, and hydromorphic soils at low points (IPEAN, 1967:9). The tropical moist forest vegetation (Holdridge, 1967) exhibits the following climax species: canela de velha (Miconia spp.), matamatá (Eschweilera spp.), tamanqueiro (Tagara rhoifolia), morototó (Didymopanax morototoni Aubl.), castanha do Pará (Bertholetia excelsis) and various Bauhinia species. Since the area has been under aboriginal, as well as modern, agricultural usage, Amazonian secondary succession species are also evident: imbaúba (Cecropia spp.), tucumá (Astrocarium spp.), piquiá (Caryocar villosum Aub.), jutaí (Hymenhea spp.), cupuaçú (Theobroma grandiflorum Spreg.) and babaçú (Orbignia speciosa). The area has agricultural potential for intensive cultivation, since part of it lies among the 18 percent of tropical soils with high base status, adequate soluble nutrients, few toxicity problems, and near-neutral pH.

As is true of the flora, the fauna species are incredibly varied. The rate of evolution and speciation is considered to be higher in tropical forest than in any other area (Meggers et al., 1973). Such variety may hide the fact that the number of individuals of each species is actually very small (E. Odum, 1971:401; H. Odum and Pigeon, 1970). Bird and monkey species are abundant in the upper layers of vegetation, while rodents and other large species dominate the ground level. Here the largest rodent on earth, the capybara (Hydrochoerus hydrochoeris) finds his habitat, alongside the fierce jaguar (Felix onça, Linn.) and the white-lipped peccary (Tayassu pecari Linn.).[4] Since shifting cultivation does not expose the forest to intense habitation or prolonged cultivation, it maintains this great variety of floral and faunal species. Ecologists have long argued that such a varied gene pool is a valuable resource and should be perpetuated.

All things being equal, shifting cultivation should be a preferrable form of agriculture in those areas which are covered by tropical rain forest. It is inexpensive in terms of money and labor-time, and preserves relatively high fertility in the soils (Boserup, 1965). Ecologically speaking, the area cultivated at any one time is usually small, and forest succession can recover the area rapidly. For populations with low capital resources and low levels of affordable technology, it is the only agricultural system that can effectively provide subsistence. One must consider also that even if modern tools and techniques were available, their use may in the final analysis entail greater expense due to labor and fuel costs. Shifting cultivation is, therefore, a favorable system of agriculture for both the stability of the forest and the subsistence of a low density population with few economic options.

Where population pressure is combined with agricultural expansion into new lands, shifting cultivation is often no better a solution than intensive methods. With increased population and the arrival of newcomers, fallow times are cut short, and cropping is intensified to the point where the fertility of the soil is exhausted and native vegetation can no longer return to replenish lost nutrients. Modification of native systems, such as was tried in experiments in the Belgian Congo,[5] now Zaire, offer a potential solution, but it requires as much control and management as the more intensive methods. For this reason such modifications may prove impractical for farmers with few capital resources and little management experience.

The Altamira Area

The county (municípío) of Altamira and its municipal seat are located at 80 meters above sea level.[6] The county has an average of only 0.10 persons per square kilometer (IBGE, 1970), and a total population, including the urban areas, of 15,345 persons (See Table 3). The rural portion of this population is scattered over an area of 153,862 square kilometers. Most of these people subsist on their production from shifting cultivation along the streams and rivers, and gain small cash incomes from the sale of wild game, prized pelts, Brazil nuts, and small volumes of agricultural produce. Population growth in the municípío has been steady since the 1940's, despite the reapportionment of the county in 1962.[7]

The port of Vitoria, 47 kilometers from Altamira, acts to connect Altamira with the Xingú River and the outside world (See Figure 10). The head of the longshoremen's union told us that, before the time of the highway, Altamira was largely self-sufficient in basic food items, and

TABLE 3

POPULATION FIGURES FOR ALTAMIRA AND ALTAMIRA COUNTY

	Total Municipio Population	Total Urban Population	% Urban	Total Rural Population	% Rural	Land Area in km.^{2}
1940	4,883	1,573	32.2	3,310	67.8	279,071
1950	9,415	2,625	27.9	6,790	72.1	279,071
1960	12,090	3,425	28.3	8,665	71.7	279,071
1970	15,345	5,741	37.4	9,604	62.6	153,862
1973	37,415	11,740	31.4	25,675	68.6	153,862

Source: IBGE in Altamira.

even exported rice, coffee, and beans to Belem. With the coming of the highway, however, the population grew too fast, and production of certain items lagged behind demand. Large imports of food have now become necessary. Because some of the larger purchases of food are made by upper and middle class administrators, luxury food items such as canned foods, imported liquor, and better qualities of rice[8] are now being brought in. It is possible that much of the current surplus of basic staples in Altamira may be leaving by other transport means. Wholesalers in Altamira indicate that rice bought from farm settlers is sent by truck to the South, where better prices can be obtained than in Belem.[9]

Altamira changed with the coming of the highway.[10] An economic boom occurred during the occupation of the town by road construction companies. Since their leaving, the boom has quieted, and the town is now restabilizing itself at a higher level of development. There are more people, more businesses, more services, more banks, more cars, and better communications with the outside. And yet, many of the merchants who came to get rich have left unrewarded. Some of the older businessmen in town attribute this to overspecialization. "In the interior, one must sell everything," is the theme repeated time and again. This piece of local wisdom can be seen at work in the rapid turnover of those stores which sell only

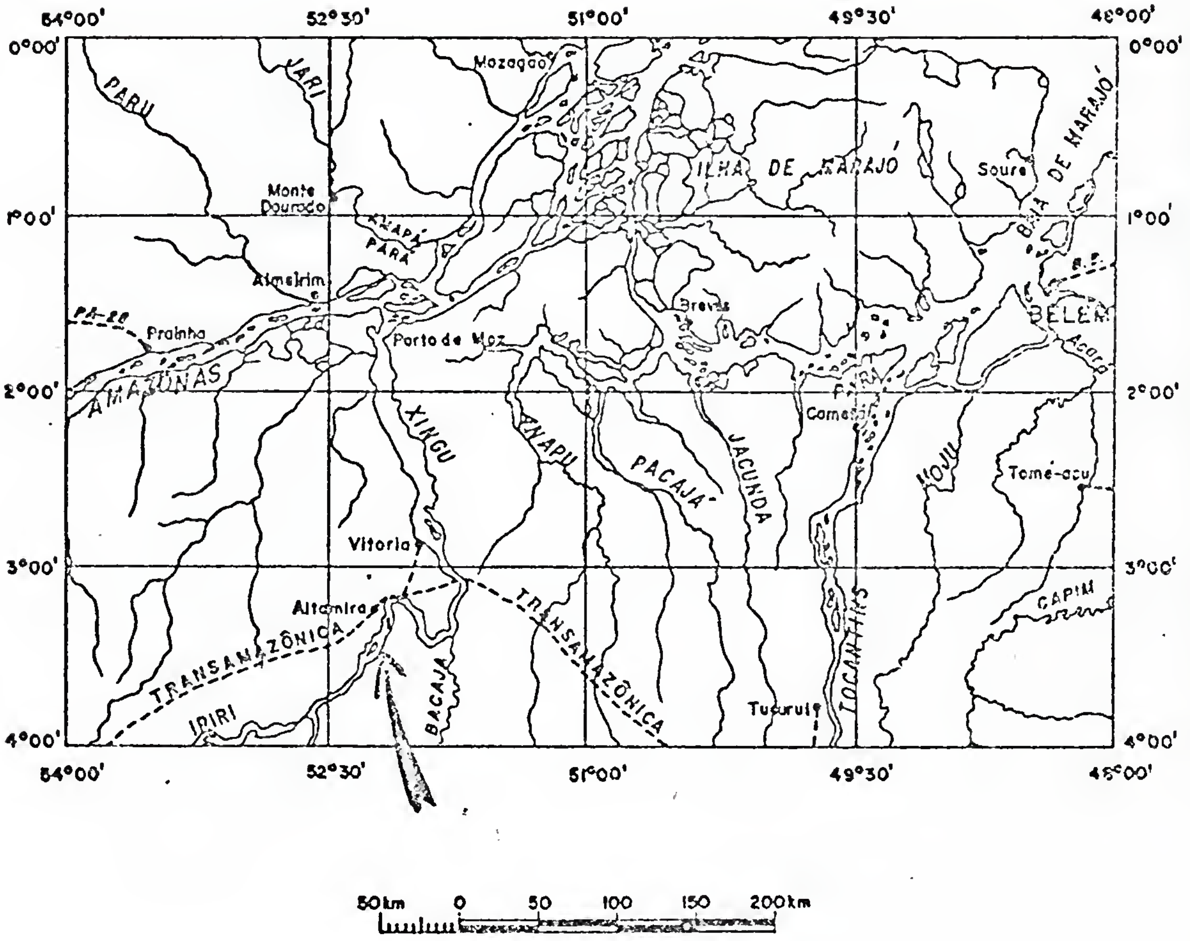


Figure 10. Map showing the Location of Altamira

Source: Ministério das Minas e Energia. Levantamento de Recursos Naturais, 1974, p. 1/10.

TABLE 4

COMPARATIVE PRICES AMONG FOUR AMAZONIAN COMMUNITIES

	Belem	Altamira	São Felix do Xingú	Gurupá	Units
Beer	3	5	10	7	bottle
Soft drinks	1	2	5	2.50	bottle
Canned meat	5	7	10	8	250 gms.
Sardines	1	2	3	2.50	can
Powdered milk	7	9	15	14	400 gms.
Manioc flour[a]	1-1.50	2.50	2	2	kilogram
Beef[b]	5-10	18	10	6[c]	kilogram
Rice[d]	2	2.50-3	3	3	kilogram
Fish[e]	1	3-5	1-2	1-2	kilogram
Distance from Belem	--	360 km.	600 km.	250 km.	

a,b,d, and e represent foods which may or may not be produced locally. All others are imported, except for the beer and soft drinks which are bottled locally in Belem.

[c] The beef prices in Gurupá are subsidized by the mayor.

clothes, or fabric, or car parts. The older businesses earned a share of the boom business while it lasted but after it left, they still managed to retain a solid group of constant customers.

As might be expected, prices in the frontier area of Altamira are high, but they are generally lower than in isolated riverine Amazon towns such as Gurupá and São Felix do Xingú. A comparison of a few items bears this out (See Table 4 above).

The boom situation is, therefore, not as exploitative as that found in traditional towns where a small number of commercial patrons and maverick river traders (regatões) regulate prices at will. Competition is fierce in Altamira, and this serves as a partial constraint on inflationary prices. Between 1972 and 1974, businessmen, both old and new, agreed that weekly profits had been halved by the exit of cash-laden construction crews. In 1972 Altamira had four wholesalers and 267 retailers. All the wholesalers were new merchants who had come from the Center-South. Three gas stations, three banks, one hospital, six drugstores, eight hotels, six restaurants, an unknown number of prostitutes, and 28 bars provided services. A group of professionals included six physicians, five dentists, two lawyers, one engineer, and two agronomists. This number did not include technical advisors or recent arrivals associated with the highway project. Registered vehicles numbered 610 and were evenly divided between truck and passenger cars (IBGE, 1972). The boom brought many changes to the town of Altamira. Its rural environs, however, had undergone a limited change nearly a generation before the coming of the Transamazon Highway. The change began when the município opened some of its county-owned lands for lease and sale to interested farmers. This incidental fact, as we will briefly see, will soon become part of the history of the Transamazon.

Pre-Transamazon Colonization

The agricultural production of Altamira grew following the opening of município lands to farmers in the 1950's. One entrepreneur from the Northeastern state of Piauí came to Pará in 1954 when he heard that Altamira was making land available. After a reconnaissance of the area, he went back to his town of Parnaíba and recruited volunteers to come as sharecroppers and work the land. Nearly 75 families came and began to cut the first path west out of Altamira, as far as 23 kilometers into the virgin area. The men worked in teams for João Pessinho, and the women cooked and washed for the men. In a few years, João Pessinho managed to establish pastures and purchase cattle, largely through the labor of these pioneers.

Unlike more established patrons, João Pessinho worked alongside his men, and all recalled how energetic and fair he was. Nevertheless, like a true patrão, he received half of the produce in return for having brought the workers to the new land. Once there, many could not afford the long trip back to the Northeast, and the harshness of having to adapt to the new area has left bitter memories among some. These pioneers had been in Altamira 20 years when the Transamazon construction reached them. They took up lots apportioned by the colonization agency and became independent of their former patron. João Pessinho, in the meantime, had claimed an important post with the colonization agency as "the region's pioneer." The tortuous path eked out in the jungle between Altamira and the Pessinho holdings became the baseline for the Altamira-Itaituba stretch of the Highway. The former workers' quarters became a temporary camp which still houses the inflowing pioneer colonists.

The opening of municipio lands in the 1950's also attracted local paraenses. Unlike the Northeasterners, who cut a path to their new lands, these local caboclos[11] penetrated in a more traditional way, by way of streams, to the municipio lands west of Altamira. They built thatched homes near the water's edge and began to cultivate small patches of land using a slash-and-burn method. Produce was carried on their backs to the quarters of the Pessinho group. From there the sacks of produce were taken to Altamira on mules rented from João Pessinho.

These Pará caboclos had largely come from a riverine environment where they planted small inter-cropped fields, and fished or hunted for their protein. They made farinha puba[12] and porronca[13] to earn cash in the nearby town. Most of their needs were supplied by their own labor, with the exception of salt, liquor, sugar, metal tools, and kerosene. Cooking fat was supplied by pork lard or by processing babaçú palm oil. Spices were home-grown, and baskets, brooms, and other non-metal utensils were home-produced. While river fish once provided the most abundant protein source in their former riverine homes, they began to emphasize game meats in the new upland area. Even hunting, however, has changed in the last few years. They recall how it was possible to hunt tapir (Tapirus terrestris Linn.) only a few meters away from the house in the early days. Now with the arrival of the highway and thousands of colonists, they must follow the fame further and further into the forest.

The greater part of these caboclos are the children and grandchildren of the Northeastern migrants who came to the Amazon during the Rubber Era. Amazon rubber extraction required large quantities of cheap and hardy labor. During the course of rubber prosperity[14] numerous attempts were made to attract workers on a large scale. All schemes ended in failure until a severe drought struck the Northeast in 1879, and its inhabitants became easily persuaded by labor recruiters (Melby, 1966). The tale of suffering of these rubber gatherers has been told (Cunha, 1913; Wagley, 1964), but what few authors have mentioned is the absorption of the survivors into the regional culture (a cultura do caboclo amazonense) as they learned the adaptive ways required for subsistence in the isolated riverine environment (Wagley, 1951, 1952, 1964; Moran, 1974).

The Amazonian caboclo is a generally disparaged human type. While writers tend to romanticize his way of life, the truth is that no one wants to be a caboclo. References usually imply low education, laziness, drunkenness, and poor nutritional and hygienic habits. Nor is a caboclo to be readily trusted, according to common belief. It is not surprising, then, to see little mention of the existing caboclo population by government planners in the colonization blueprints. Their schemes were aimed at bringing land-hungry Northeasterners, who in turn would hopefully be influenced by the "technologically innovative" Southerners, to the "demographically empty" Amazon. The caboclo was never considered in the plans, except in brief asides which pointed out that the way of life of traditional Amazon communities was unmodern and therefore, doomed (Jornal da Transamazônica, 1972:2; Santos, 1968:30).

In the first few years, caboclos and the new incoming colonists had little contact. The new colonists were too concerned with bureaucratic paperwork and getting settled to take much note of the local population. Dealings between the town of Altamira and the Transamazon settlers took place in the area of services, administration, education, marketing and credit. The town did not play much of a role in the social life of the newcomers, although they enjoyed going there for market. The town offered the regional hospital and a number of private physicians and dentists who provided health care beyond the elementary first aid offered at the agrovila. Likewise, shops, supermarkets, and clothing stores were available. The colonization agencies were based in Altamira until 1974, at which time they were moved to the agropolis, "New Brazil." Dealings and complaints having to do with housing, purchase of tools, minimum salary, and the securing of bank credit had to be handled in town. Settlers with children at the secondary school level sent them to the Catholic school in town, if they could afford to do so.[15] Primary teachers from the agrovilas went to Altamira during school breaks to complete their own secondary education in intensive courses.

Of most interest to colonists are the marketing and credit activities of Altamira. Once their annual bank credit is approved, settlers receive their payments in six installments. This means going to town at least every two months to pick up these installments. On such days, colonists also do household shopping, or seek contacts that might lead to a temporary job in town or along the highway. The municipal market is held on Saturday morning, and one must arrive early to buy the better and freshest produce such as farinha, eggs, fruits, citrus, and fish. Prices drop with the coming of the afternoon as does the quality of the items. The settlers also come to sell as well as buy. Several vegetable growers in Vila Roxa sell lettuce, green onion, couve (Brassica spp.),[16] tomatoes, green pepper, and other products from their gardens. The majority of colonists do not buy or sell in this public market, however. Since the bank is closed on Saturday, businessmen note that Monday brings many more Transamazon farmers to town to do their shopping. The colonists also have another reason for avoiding the market, which involves the availability of credit. Most colonists can buy their food stuffs and household wares on credit in the small private shops any day of the week, a privilege which is not allowed at the municipally run market.

NOTES

[1] *Biome* is "the largest land community which it is convenient to recognize. In a given biome the *life form* of the climatic climax vegetation is uniform. ... Climatic data may be used to delimit the major vegetation formations" (E. Odum, 1971:378).

[2] The *várzea*, or flood plain, occupies a very small portion of the Basin, but silt deposition during flooding makes this a potentially rich agricultural area (Falesi, 1974:227).

[3] High and low base status refers to the proportion of the cation exchange capacity occupied by bases. A definite correlation exists between the percentage base saturation of soils and pH. Low base status soils have low pH, while high base status soils have higher pH values (Buckman and Brady, 1969:101-102).

[4] Appendix 4 provides a list of animals in the Altamira area that are likely to be affected by the Transamazon Highway.

[5] Jurion (1969) discusses this rational corridor system of field rotation to aid the re-establishment of forest succession.

[6] The municipio of Altamira is located at 3°12" Latitude and 52°13' Longitude, near the center of the state of Pará, and on the left margin of the river Xingú.

[7] On this date, parts of the municipios of Altamira and Senador José Porfírio were subdivided and a new municipio, São Félix do Xingú, was created.

[8] This is the whiter, long-grain rice commonly called "export quality" rice, and not the roughly-milled rice commonly processed in the area. Long grain rice is especially esteemed by Southerners, and has become, with other industrialized foods, a status item.

[9] One major wholesaler bought rice locally for Cr$45 a sack and sold it to a Goiás firm for Cr$103 a sack.

[10] Recently a Master's thesis was written on the topic by Curtis Glick, "The Cultural Impact of the Trans-Amazon Highway on a Traditional Community" (University of Florida, 1974) based on his two-month stay in the region.

[11] Caboclo, is a term widely used in Brazil to denote persons living in the backlands, or more broadly, for anyone in a lower social position than the speaker. In the Amazon, urban populations refer to the rural mestizo populations as caboclos, while the mestizo population uses this term in referring to Indians! (Moran, 1974:136).

[12] Farinha puba is a coarse, yellow meal made from manioc.

[13] Porronca is home-cured tobacco.

[14] This period lasted approximately from 1890 to 1920 (Reis, 1942).

[15] The county of Altamira has 10,571 students in eight town schools and in 35 rural schools. All schools in town are of brick and tile, and those in rural areas are more commonly wooden, wattle-and-daub or thatch structures of only one or two rooms (Bushman, 1974: field notes).

[16] Couve is a member of the cabbage family and bears a great similarity to collards.

CHAPTER IV

THE PEOPLE COME TOGETHER

The First Encounters with the New Land

After being selected, processed, and immunized in their home regions, the colonists and their families were transported to the Highway area. For some the trip lasted a few hours, for others the journey took over a month. They had come by various means of transportation, trucks, boats, and jet planes. The women were soon homesick for their families, the men eager to have their land, the children were beginning to tire. One recalls witnessing a truckload of women and children begging for something to drink after being in the sun for hours. The traveling brought with it the usual tourist's maladies. The migrants were people unaccustomed to going through such discomfort. Many of the children suffered from gastro-intestinal ills and dehydration following the long trip, strange foods, and for several a great many vaccinations and shots. The children of other families, however, were thrilled by their first plane flight and enthusiastically moved from airport to airport until they arrived at the dusty little runway in Altamira.

On arrival, settlers were taken to the colonization office to be processed again. Waves of large groups (turmas) came from various areas, and the friendships formed on the long trip were the earliest social bonds of settlers. Those early hours were full of hope and confusion. Altamira may have been a bustling frontier town, but it was dusty in summer and muddy in winter. The newcomers had no place of their own to which to go, the women recall crying a great deal, and the men recall the initial disappointment and frustration.

The government had envisioned selecting 75 percent of the settlers from the Northeastern areas of "social tension," and the other 25 percent from the South, as a "demonstration effect" to the others. What emerged demographically was quite different, however. Below are the figures which show the relative percentages of colonists coming from each region. They were obtained by checking the file of each colonist in the Altamira Project, and later confirmed by a letter from the Brasilia headquarters of INCRA.

TABLE 5

ALTAMIRA COLONIST POPULATION BY REGION OF PREVIOUS ORIGIN

North Region	36%
Northeast Region	30%
Center-West Region	11%
South Region	23%
Total	100%

This indicates that two groups made unexpected contributions to Transamazon colonization; the local Amazon populations, and pioneers from the Center-West, a frontier area which was opened only a few years before. The small percentage from the Northeast, while unexpected, resulted in advantages from this more balanced population that emerged by 1974.

The colonization plan did not foresee such a sizable contingent of local Amazonian settlers. Many, but not all, were already in the region. These persons had lived either as townspeople in Altamira or along river banks engaged in shifting agriculture.[1] Due to the limited opportunities available, their agriculture was chiefly geared to subsistence, and their lifestyle, of necessity, became one of independent solitude.[2] The INCRA administrator in Altamira contacted some of the local men and asked them to show him the areas of good soil. Willingly, the caboclos pointed out the areas of farmable soil, and others that would present agricultural difficulties. The small farm belt involved some of the most fertile soils in the Amazonian terra firme (Falesi, 1972:192), but it also cut through infertile sandy soils and leached podzols. However, the colonization timetable established in far away Brasilia pressured the local administrator to abandon such selectivity of soils and make all the lots available to anyone willing to assume their ownership.

Apart from this one incident when local caboclos were consulted, they have been largely ignored by government agents. Other problems have arisen. The caboclos who had begun to farm the county-leased lands years earlier tended to build their homes along the isolated rivulets, far from the path of the oncoming highway. Their farms were often overlooked by the surveyors who marked out the uniform rectangular lots of the colonization project. Later this led to the assignment of land to newcomers, even though these lands had previously been granted by the county to the caboclos. The pace of colonization was simply too rapid to check the records. Land titles had been vague, and boundaries had been set by natural markers such as streams, rather than by neat topographic lines. Many of the older tenants of these lands lost their cleared plots to newcomers, and inherited 100 hectares of virgin forest. Serious conflicts emerged at times, and were resolved in ways that left both sides unhappy with the outcome. The loser was commonly the caboclo, especially in the first year of colonization. The administrators had been instructed that the purpose of the project was to settle Northeasterners. Local inhabitants tended to lose out to the priority of putting these drought victims on the land.

The major shock which came to the incoming colonists who arrived in early 1971 was the absence of the promised houses. They lived in a common tent with road construction gangs and other families. The men were put to work by the colonization agency to open the side roads and build the agrovila homes. Meals and pharmaceuticals were provided by the government, but the bills were put on the individual accounts. Later the colonists learned that these initial debts were to be paid in the first three years. The earliest pioneers were natives of Rio Grande do Norte, and local Amazon caboclos. They bore the brunt of early difficulties, but also the advantages of being among the first to settle in. Many of these men had come without their families first to establish their homes and farms. These first settlers were allowed to choose their homes in the agrovila, and some managed to establish farms in the first year. They also received several benefits from INCRA, such as nearby distribution of food, tools available at cost, and free furniture and poultry. Such benefits were later cut from the program.

These early colonists worked for a few months until their houses were ready, and then began to work on their chosen lots. Those who came later were taken in the back of trucks to some point along the highway and told to choose their lots. While some complained that lots had been assigned by "lottery,"[3] the majority were allowed to select the site for their lots.

Pará caboclos, of course, were among the first to choose lots, according to criteria which were important to them. These included proximity to the main highway and type of forest vegetation that they found.[4] According to caboclos, the best land for agricultural purpose would be that containing certain species and types of plants (See Table 6 on the next page for the vegetation indicative of good soils). Generally, these were described as trees of small diameter (paus finos), or liana forest (cipoal). Most of the caboclos interviewed indicated that they had noticed their future lots years before, while hunting in the forest. The fact that they were the first there does not mean that they preempted the good soils, leaving only weaker ones for the new settlers. However, the soil samples seem to indicate that their criteria were adequate (See Table 7). Good organic matter content, low exchangeable aluminum levels, pH of 6.0 or better, and adequate potassium and phosphorus contents were among the qualities present in their soils.

Newcomers were confused by the lush vegetation. They recognized few tree species at all. The government agents who assisted in lot assignments were not very helpful either. Road construction and settlement had proceeded too quickly and analysis of the various soils had lagged behind. A preliminary discussion of the soils was available only in 1972 and included samples from along the main highway artery, not along the side roads where most of the lots were being distributed

TABLE 6

SPECIES OF FOREST VEGETATION USED BY CABOCLOS TO SELECT AGRICULTURAL LAND

Local Term	Scientific Name
Pau d'arco or ipé (yellow variety)	*Tabebuia serratifolia*, D. Don.
Pau d'arco or ipé (purple variety)	*Tabebuia vilaceae*, Hub.
Faveira	*Piptadenia* spp.
Mororó	*Bauhinia* spp.
Maxarimbé	*Emmotum* spp.
Pinheiro preto	Unidentified
Babaçú	*Orbignya martiana*
Açaí	*Euterpe oleracea* Mart.

TABLE 7

SOILS ASSOCIATED WITH CABOCLO CRITERIA[a]

	pH[b]	P[c] (ppm)	K[d]	Ca+Mg[e]	Sum of Exchangeable Bases	Exchangeable[f] Aluminum	Effective C E C	C[g] (%)	N[h] (%)	O.M[i] (%)	C/N Ratio	Soil Color[j] (Wet)
			(In Milliequivalents per 100 grams)									
Forest	5.8	1	0.18	7.2	7.38	Traces	7.38	1.29	0.23	2.23	6	10 R 2/3
	4.0	1	0.09	0.3	0.39	2.5	2.89	1.11	0.12	1.90	9	10 YR 4/4.5
First Year	6.0	48	0.18	8.9	9.08	Traces	9.08	2.31	0.22	3.97	11	10 YR 4/2.5
Fields	5.6	3	0.12	7.6	7.72	Traces	7.72	1.78	0.22	3.06	8	10 YR 3/2.5
	7.1	26	0.09	4.8	4.89	Traces	4.89	1.02	0.10	1.76	10	10 YR 2/2
Average	5.9	15.8	0.13	5.76	5.89	0.5	6.39	1.50	0.18	2.58	8.8	
Range	4.0- 7.1	1-48	0.09- 0.18	0.3- 8.9	0.39- 9.08	Traces- 2.5	2.89- 9.08	1.02- 2.31	0.10- 0.23	1.76- 3.97	6-11	

[a-j] The samples in Tables 7 and 9 were collected using a Hoffer soil sampler. Each sample was collected at 0-10 cm. depth and was made up of at least 15 random cores each. The samples were described, labeled and sent for analysis to the Instituto de Pesquisa e Experimentação Agropecuária do Norte. The laboratory methods are included in Appendix 7.

(Falesi, 1972). The arriving settlers were faced with two options: either they must choose according to criteria that they knew, or ask a caboclo.

Many opted for the first choice, and the use of non-Amazonian criteria to select good farm land led in time to disappointing results. One such criterion was "the bigger the trees, the better the soil." Choosing trees with large diameters and height (paus grossos) meant that, in the Altamira region, they chose forests with the species listed in Table 8. These are the larger buttressed trees whose shallow roots seek nourishment from fallen leaves and broken limbs. Soil and litterfall under this type of vegetation is poor, and even first year crop yields can be disappointing (See Table 9). Another criterion the newcomers often used was particle composition of the soil. The colonists felt that the heavier and stickier the clay, the more preferable it was. While some good soils would fall in this category, some of these heavy clays would be among the first to create drainage problems, and suffer from compaction after forest clearing and cropping.

Not all colonists followed these unsuitable criteria for choosing lots. Some asked the caboclos what to look for. Even in their first encounter with the new environment, we can see that some of the colonists behaved differently from others. Before elaborating on the different strategies used by the various colonists to choose their lots, perhaps we should know something about these new settlers. What are their backgrounds? One of the simplest ways to describe the multitude of differences among the various colonists would be to construct a simple typology.

TABLE 8

FOREST VEGETATION INDICATIVE OF POOR AGRICULTURAL SOILS

Local Name	Scientific Name
Acapú	*Vouacapoua americana*, Aubl.
Jarana	*Holopyxidium jarana* Ducke
Sumaúma	*Ceiba pentandra* Gaertn.
Melancieira	*Alexa grandiflora* Ducke
Sapucaia	*Lecythis paraensis* Linn.
Piquí	*Caryocar microcarpum* (or *Villosum* Pers.)
Cajú-Açú	*Anacardium giganteum* Engl.
Massaranduba	*Manilkara huberi* (or *Mimusops huberi* Ducke)

TABLE 9

SOILS ASSOCIATED WITH LARGE TREES

	pH	P (ppm)	K	Ca+Mg	Sum of Exchangeable Bases	Exchangeable Aluminum	Effective C E C	C (%)	N (%)	O.M. (%)	C/N Ratio	Soil Color (Wet)
				(In Milliequivalents per 100 grams)								
Forest	5.7	1	.35	5.4	5.75	Traces	5.75	1.58	.16	2.71	10	5 YR 3/4.5
	4.1	4	.04	0.1	0.14	1.0	1.14	0.68	0.06	1.17	11	10 YR 4/4
First Year	4.1	2	.20	1.3	1.50	5.9	7.4	1.83	0.26	3.15	7	7.5 YR 4/3.5
	4.3	4	.16	0.5	0.66	5.0	5.66	3.20	0.24	5.51	13	7.5 YR 3/3
	4.5	1	.25	1.5	1.75	5.6	7.35	1.78	0.22	3.06	8	7.5 YR 4.5/6
Average	4.5	2.4	0.2	1.76	1.95	3.5	5.46	1.81	.19	3.12	9.8	
Range	4.1-5.7	1-4	.04-.35	.1-5.4	0.66-5.75	Traces-5.9	1.14-7.4	0.68-3.20	.06-.26	1.17-5.51	7-13	

A Typology of Transamazon Farmers

Many efforts have been made in an attempt to order and explain the socio-cultural differences in behavior among the members of complex societies. Often this involves the use of such concepts as social class and various typologies. The latter especially, has evolved out of the description of sub-cultures within complex national societies. Examples by Redfield (1941), Steward (1956), and Wagley (1968:81-117), are well-known for Latin America. Peasant groups have been frequently classified through the use of typologies. Wagley, for instance, has developed a two-class division of Latin American peasants; the Modern Indian, and Mestizo types (1968:123). Wolf (1955:452-471) has made a similar distinction, but labels his categories as Corporate versus Open peasant types. Modern Indian or Corporate peasants are characterized by being distinct entities, culturally and socially. Such communities look inward rather than outward for their identity. Mestizo or Open peasant communities identify more with the nation, generally use the national language, are more closely tied to the modern economic system, and own land privately rather than corporately. Such models can be helpful in sifting out the variety present in any community and arriving at conclusions which do more than merely describe individuals.

The question immediately arises as to whether the Transamazon colonists should be classified as peasants. Vila Roxa indeed is part of a complex, heterogeneous Brazilian society: While the Transamazon agrarians do share some characteristics with traditional peasant groups, the differences are too great to justify use of that term in this particular case, however. For example, Transamazon farmers, as a whole do not hold the concept of the "limited good," nor are they fatalistic. They believe that they can improve their situation, and most aspire to own cattle, have productive stands of tree crops, and provide better education for their children. Practical steps toward achieving these goals are already underway. The very fact that these pioneers left most of their kinfolk to come to the Amazon is indicative that they do not necessarily believe in the subordination of individual will to the wishes of the family. Many of their family members, both extended and nuclear vehemently opposed such a move.

In addition they do not automatically oppose rapid innovation, as do more traditionally inclined peasants. Whenever a farming innovation has been shown to be useful, it is taken up enthusiastically. A number of Vila Roxa residents, for instance, have been very experimental in their approach to farming and horticulture. The need for immediate gratification, noted in peasant studies is also absent here. Relatively little alcohol is consumed, and families are saving whenever possible for emergencies and other needs. The concept of time is also important to these farmers. At meetings they demonstrate unusual punctuality, given the difficulties of arranging public transportation in the area. They are upset by the more cavalier attitude toward being on time that is exhibited by government representatives. Their attentions are not turned inwards on their village, rather they are aware of national and international politics of the greater world around them.

The Transamazon population does not picture itself as belonging to the peasantry. As previously noted, their backgrounds are varied and their approaches to earning a living are multiple. Some had been rural, while others had been urban. Some had never farmed, while others had spent all their lives tilling the land. Very little traditionalism was evident, except in certain features of the broader Great Tradition of Brazilian life. Only a small portion of the farmers expressed any special attachment to their land, and such sentiments certainly held no religious overtones. Many were quite explicit in indicating that if better economic options appeared they would be quick to seek them, leaving both land and village in the pursuit of economic advantage. This population is modern in nearly every conceivable way. Table 10 summarizes the distinctive traits of peasants which are or are not held by the colonist population. Since many of these traits are negative, it would seem that the term "peasant" is not particularly applicable. It is for these reasons that the terms "small-farm system" and "farmers," will be used throughout the remaining discussion of the various types of colonists.

The Transamazon colonists can first be divided into two major groupings: the brokers and the clients. This two-fold division describes the most basic socio-economic relationship in the area. Brokers are those persons who through their own managerial skills, generate their own capital and re-invest a major portion back into their enterprises. The clients are persons who depend on the brokers or on outside institutions to provide a steady flow of cash in order to survive. Most of their capital resources go for consumption items rather than for farm investment. Brokers also tend to be more geographically stable than clients. They have often owned land or durable goods such as trucks or machinery. A certain managerial expertise has come from their learning the resources of an area and investing heavily in their use. In contrast, clients are basically a labor force; they go where there is a demand for their labor. Their constant mobility has kept them from acquiring the managerial acumen

TABLE 10

POSSESSION OF PEASANT TRAITS BY TRANSAMAZON COLONISTS

Distinctive Traits of Peasant Cultures	Transamazon Colonists
Life is considered sacred	no
Community is homogeneous	no
Reverence toward the land	no
Production for own use	yes[a]
Endogamous village marriages	no
Unspecialized occupations among the village folk	no
Social organization based on kinship	no
Idea of the "limited good"	no
Household is production/consumption unit	yes[b]
Familism	no
Opposition to innovation	no
Fatalism	no
Limited aspirations	no
Lack of deferred gratifications	no
Time is not important	no
Unaware of national and international affairs	no
Distrust in government	yes[c]
Mutual distrust	yes
Low empathy	no

Sources: Wolf, 1955; Redfield, 1960; Wagley, 1968; and Foster, 1953.

[a] Some farmers produce for their own needs; others earn salaries with which to buy their consumer needs. Surpluses have been low, but that has been more a function of bad seeds and early rains than of cultural preference.

[b] One group uses the household as the primary work unit; others utilize a great deal of wage labor, since their wives and children do not work in the farm.

[c] Distrust in the national or state government was not evident. Feelings of distrust exist, however, towards local colonization officials who are viewed as undoing the sincere efforts of the national leaders.

necessary to run their own commercial or agricultural enterprise. Basically, then, we have distinguished between colonists who are rural managers and those who are rural proletarians. In Vila Roxa, for instance, there were roughly 20 brokers and 30 who could be classified as client types.

These two major groupings are too broad to be operationally useful. If one is adequately to account for the performance of farmers in the Transamazon, a more precise typology must be employed. Thus, within each of the two broad categories, two sub-types may be defined. Brokers can be sub-divided into entrepreneurs and independent farmers; clients into artisan-farmers and laborer-farmers.[5]

The category of clients is essentially made up of two forms of rural proletarians (Taylor, 1975:17). First are the laborer-farmers who come from largely rural, sharecropping, or migrant labor backgrounds. These people are characterized by a high degree of mobility and possess few durable goods. Figure 11 compares the number of previous migrations among the various types of farmers. Laborer-farmers are persons who have customarily worked for others. They have had many years in low-skilled agricultural work but little experience in farm management, and have repeatedly failed to do well economically. They traditionally have been tied to the landowner-patrons by symbiotic bonds which have provided them with security, yet effectively kept them in their low economic position. There has been comfort in the personalistic treatment by the patrão since he has often been tied to the laborers' families through fictive kin ties (compadrio).[6] When crops failed, it was always reassuring to know that the patron would not fail to provide a minimum subsistence. The patron gained by this arrangement by paying low wages, expecting hard work, and

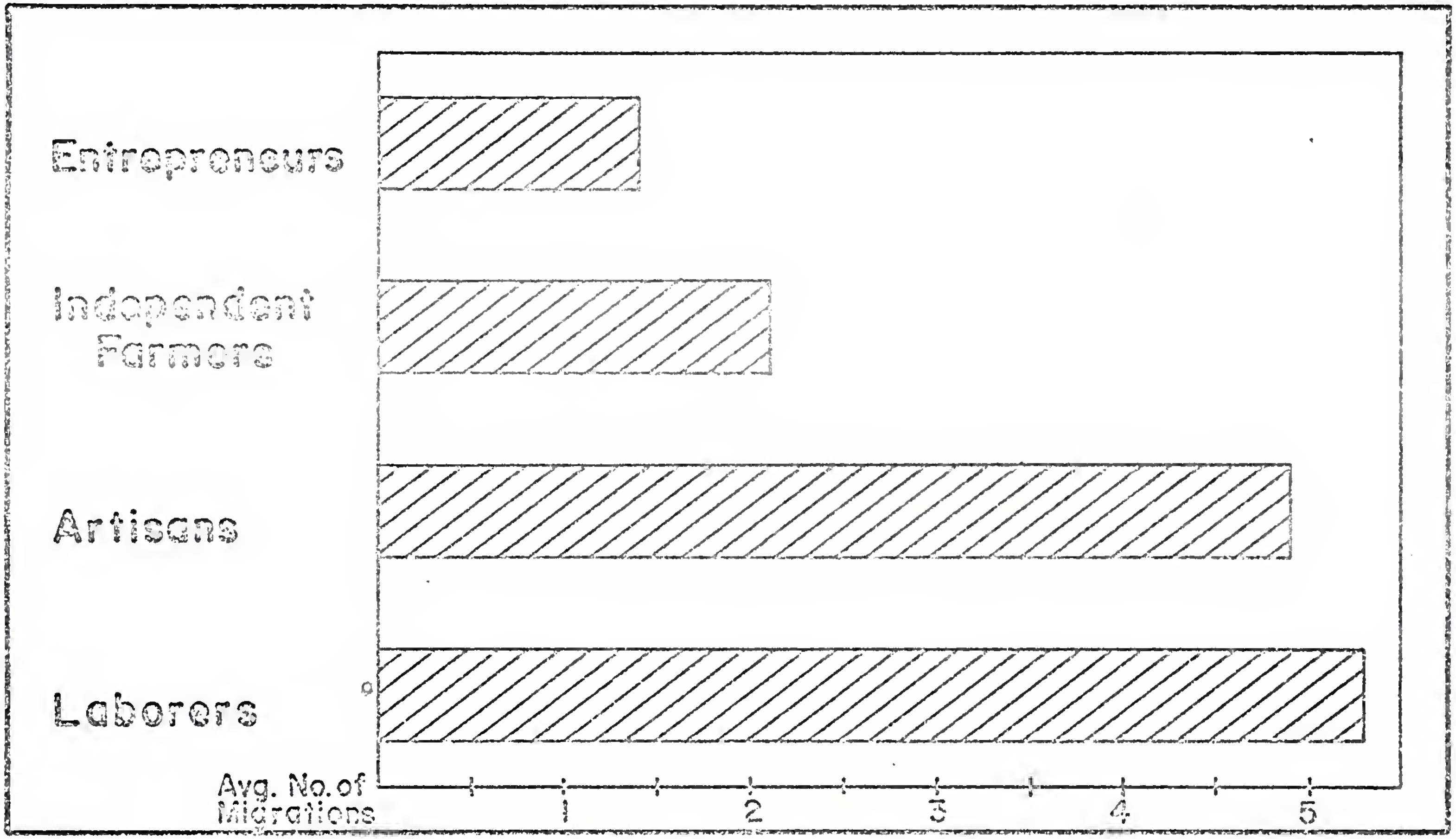


Figure 11. Number of Previous Migrations Among the Four Types of Farmers

charging high prices in the fazenda-run store, where credit was available to laborers. Other studies indicate that this type of laborer-farmer is less frequently found in spontaneous colonization situations (Nelson, 1973:73). This can probably be explained by the lack of personal initiative on the part of those bred in the paternalistic environment of the fazenda (Nelson, 1973:288). Because such laborers repay their patron in farm produce and deal with the local store on a debit-credit basis, they have little free cash of their own to spend on luxury consumer goods, much less durable goods.

The second sub-group of clients, the artisan-farmers, are also characterized by a high degree of mobility (See Figure 11). A major difference between them and the laborer-farmers is that the artisan-farmers' urban experience has led them to acquire either craft skills or better education, both of which qualify them for better-paying jobs. While their various skills might be considered second-rate in most urban areas, and could not provide them with as high an income as that of their urban-born competitors, such skills are in great demand in a rural area undergoing rapid development. So it is that, in the Transamazon, artisans seek and find well-paying jobs with government agencies as carpenters, stone-masons, construction foremen, and professional chauffeurs. Inasmuch as these artisans come to depend on these jobs for their livelihood, rather than relying on farm production or managerial talents, they should be considered clients rather than brokers. They use this situation to their advantage and overcome the problem of deficient farming experience by hiring others to work for them. This is a highly effective adaptation, particularly for urban persons coming into a jungle area. By working for high wages, artisans can afford to hire others who are more accustomed to rigorous agricultural labor to prepare their land. Whenever artisans are free, they learn from their workers about farming, and over time may eventually gain enough experience to become competent farmers. In the meantime, a minimal amount of their income is being invested in farm equipment and livestock. Instead, their urban tastes for expensive food, clothing, and household goods take a sizable portion of their salaries.

Coming now to the broker category, we again find two major groups. Independent farmers are a group of largely rural persons who have previously been the owners of small landholdings, or managers of landed estates. Unlike those in the client category, they have lived in the same place for most of their lives (See Figure 11). They bear some similarity to European-type mixed farmers, but are by no means identical (Wagley, 1968:126). The European independent farmer operates a self-sufficient agricultural enterprise that integrates cattle with crops. Alfalfa and oats are planted to feed the cattle, the manure is collected and used to fertilize crops, and butter and cheese are made from the milk. Other crops are planted to supply household needs, and efficient cottage processing, including canning and preserving, stores away supplies after the harvest.[7] Such a system never was transplanted to Brazil, except among the relatively small Southern population of German and Dutch descent. Sioli (1973:330-334) has indicated that such a system has worked well in the Brazilian Amazon, in an area colonized by some of these Germanic descendants in Pará's Zona Bragantina.

The independent farmers of the Transamazon are in some ways like the European farmer in that they do emphasize self-sufficiency. They plant a wide variety of crops, for both home use and market sale. They are different in that they do not generally use animals for plowing as in Southern Brazil. However, when cattle are present, their milk is processed into curdled milk (coalhada) and fresh home-made cheese (requeijão). Some of these dairy products are sold. Manure is not usually collected for fertilizer, except among German-descended independent farmers in the area. While canning and preserving are not practiced, other cottage industries more adapted to the tropical environment are utilized. Broadly speaking, the strategies of the Transamazon independent farmers, and the European farmer are similar, although their specific practices may differ. This may be more a function of adaptation to particular environments than of a difference in kind. Since most of their needs have been met through a variety of farm produce, the cash profits made from their agricultural production are returned to the farm in the form of livestock, paying for new clearings, replacing farm equipment, and some consumer goods. The independent farmers and their families supply most of the labor used in farming and cottage activities. Therefore, with relatively few farm expenditures and constant re-investment of many of the profits in the farm itself, independent farmers show increasingly greater production.

The second group of brokers, the entrepreneurs, is one of limited membership. The Altamira region abounded with adventurous entrepreneurs, but most of these were in the town's commercial sector, rather than the farm sector. Any new area needs such a group to organize people and resources so as to create a profitable flow of goods, services, and capital. Active rural entrepreneurs in the Vila Roxa area, like the independent farmers, were characterized by previous land ownership or farm administration experience, and by a low degree of previous migration.

Having comparatively high capital assets on arrival, however, gave them the competitive advantage. While the majority of colonists indicated that they arrived with very little money, entrepreneur types had an average of US$500 on arrival. This small, but nevertheless significant, amount of capital allowed them to proceed quickly with land preparation and other capital-generating activities, without having to depend on the release of government subsidized loans. Local dry goods stores were established, and vehicles were acquired to provide major sources of income for these entrepreneurs.

The management expertise of these people brought rapid results. Besides the general stores and motor vehicles, these individuals now own cattle and have large areas in pasture. While their managerial skills were first developed in rural areas, from the beginning they had to deal with urban environments and the workings of financial institutions. These dealings have given them a facility in dealing with banks, bureaucracies, and client types. The entrepreneurs serve as middlemen in both economic and social transactions in the Transamazon area.[8]

Like the independent farmers, the entrepreneurs generate a great deal of capital through the sale of goods. While the independent farmers' income principally comes from the sale of agricultural production and home processed items, that of the entrepreneurs is generated through their stores, transport services and the sale of cattle and other livestock. Both re-invest in these enterprises. Since the entrepreneurs work with much greater capital stores, they can afford to hire more workers, extend small amounts of credit, take on larger bank debts, and indulge in more consumer goods. Thus the entrepreneurs, rather than the independent farmers, are more likely to emulate the classic patron behavior, so frequently seen in Brazil.

Table 11 summarizes the diagnostic features used to place farmers in one of the four categories. Of course, marginal cases exist. When such was the case, the first two and broader questions were asked, then the more specific ones. Possession of the greatest number of features determined the categorization of the various colonists.

Each of the aforementioned categories included persons native to the Amazon region. This needs to be explicitly mentioned since the colonization scheme neglected to take the local people into consideration. This caboclo population became an important source of information to newcomers, particularly when it came to uses of the forest resources. Therefore, in discussing the four-fold typology, the differences, if any, will be pointed out between caboclos and newcomers in their use of physical, social and institutional opportunities. This additional variable, that is, local vis-a-vis non-local, may serve to elucidate certain aspects of both colonization planning and human adaptation to new environments. In the chapters that follow, the typology will be used as a heuristic device in describing the agricultural practices of farmers in the Vila Roxa area.

How did the various colonist types, for instance, choose their lots? How did they use the caboclos' knowledge about the soils in the area? Laziness, neglect and ignorance of agriculture, interest in hunting jaguars to sell their prized skins, and heavy drinking were said to be attributes of the caboclos. It is the first two "characteristics" which perhaps explain why few newcomers sought the caboclo for advice. An important government administrator in the Altamira area had even

TABLE 11

DIAGNOSTIC FEATURES OF FARMER TYPOLOGY

	BROKERS		CLIENTS	
Owners or managers	yes		no	
Frequently migrated	no		yes	
	ENTREPRENEURS	INDEPENDENT FARMERS	ARTISAN-FARMERS	LABORER-FARMERS
Urban experience	yes	no	yes	no
Owned many durable goods	yes	no	yes	no

suggested that caboclos did not know much about agriculture because their "primary" interests were hunting and rubber gathering. This was not resented by the caboclos. Though happy that the highway would bring them transportation at long last, the caboclos were wary of both the government and the newcomers. They stayed to themselves and preferred to live on their land rather than in the planned villages built by the government. Their preference, therefore, went against the nationalistic "melting pot" gregariousness encouraged by the government. The independent farmers and the entrepreneurs, however, sought out their caboclo neighbors, and asked the latter's advice about how to go about choosing good land.

Other colonists either applied the unsuitable fertility criteria discussed previously, or chose their lots solely on the basis of friendship. In the latter case they chose land near friends who, on the basis of non-Amazonia criteria, claimed knowledge of the local soils. The former are an extreme case of the client type, in that they demonstrated a high degree of dependence on others. This led to pockets of clients grouped along the isolated and seasonally-impassable sections of the side roads. All of them were tilling poor soils. While the government offered to move some of these colonists to better areas, they often refused to give up the time and investment in their lots unless all the debts incurred in such an effort were cancelled.

It was only the brokers who realized that if neither they nor the agronomists knew much about how to recognize the area's soils, the best option was to ask the local population. Entrepreneurs, in general, chose lots along the main highway artery, since so many of their economic dealings depended upon access to town and year-round transportation services. The independent farmers chose the fertile lots which were near the entrances of the side roads, and within easy walking distance to the agrovilas. Sometimes they lived on the farm itself so they could better attend to the needs of their livestock.

The Definition of a Small-Farm System

Latin American tropical agriculture has been long characterized by the simultaneous existence of a highly commercialized farming sector and a numerically large sector of small farm units which operate at a subsistence level.[9] The very word "subsistence" calls to mind images of a hard and marginal life, poor diets, disease, primitive technology, and resistance to change. To counter such in-built assumptions, we will use the term "small farmers" instead of peasants to refer to this large body of agrarians who make their living off relatively small plots of land. The term "traditional agriculture" has also been introduced for the same purpose (Schultz, 1964). The primary production of food crops is concentrated in this small farm sector (CIAT, 1974:6). Worldwide, small subsistence farms cover 40 percent of the globe's cultivated lands, and supply 60 percent of the world's population with food (Wharton Jr., 1968: v). However, it is this sector which traditionally has had limited access to production inputs, credit, storage, transportation and other services. It seems logical that, if food production is to increase substantially, there must be an effort to aid the small farm owner (Ruthenberg, 1968:11).

A small farm may be defined as a farm enterprise in which production and productivity are low, real income is low, and the principal source of labor is the farm family.[10] This applies to the majority of the Transamazon farms. The level of production on a small farm is a function of the size of the plot, and the amount of labor the farmer can supply. Since capital outlays are small, labor plays a predominant role in determining the increments to production (Mellor, 1968:210). Small farmers are not a homogeneous group. They differ widely in the amount and fertility of the land available to them, the economic setting in which they live, and in their perception of "costs" and "returns" (Mosher, 1968:7).

Until recently, economic growth has by-passed millions of rural families in all areas of Latin America. Their land and labor productivity have at best been static. This is not a result of incompetence. Within the limited means at their disposal, small farmers are doing the best they can. Their adherence to "traditional agriculture" results from a poor rate of return for their previous investments in new factors of production (Schultz, 1964:73). Indeed, small farmers have "exhausted the profitable production possibilities of the state of the arts at their disposal. Better allocation of available resources will not do much for [production] growth" (Schultz, 1964:131). With the pressing need to provide food for their families in the less favorable ecological regions, and with limited access to capital, they have emphasized home production and low-risk enterprises which, in the long-run, have given them near optimum results (Schultz, 1964:52). Because their incomes are low, a heavy penalty is exacted for failure. In a system of high interest rates, a failure which drives a farmer under the margin of subsistence and into debt may be disastrous. Such a situation eliminates the farmers' will to gamble on the probabilities which, in the long run, could have paid off (Mellor, 1968:214).

In ignoring the above restrictions on risk-taking, many innovators have portrayed small-scale farmers as conservative, poorly educated, and therefore, lacking the drive and ability to adopt new methods. The work of Schultz (1964), Netting (1974), and Foster (1973) have pointed out that such reasoning is not based on fact. The positive response of small farmers to the profit incentive has been documented by Tax (1963), and Pospisil (1963). It would be a simplification to say that "traditional small farmers" work under the same rules and constraints as the large, commercial farmer. The latter usually has political power, large amounts of capital, and the better lands (CIAT, 1974; Edwards, 1961:28). The reality is that small farmers have been offered few, if any, agricultural opportunities that did not involve a high degree of risk (Johnson, 1971). The small farmer in the tropics, for example, acts wisely when he rejects newer "temperate technology" and opts for time-proven agricultural practices (Upton, 1973:5). When a farmer works at subsistence level, survival comes first, the profit motive only later. It is the lack of recognition of this primacy of survival over profit that has led to the repeated development of ineffective governmental programs for improving the lot of small farmers.

Modernizing the traditional agriculture of tropical small farmers is no mean task. It requires thorough knowledge of the ecological location of the small farmers, the socio-economic and political constraints with which they work, and correct timing for introducing innovations. While the tropics are highly conducive to uninterrupted plant growth, they are also favorable to many pests and diseases. Surpluses for commercial purposes can be obtained with the adoption of modern technology. This option though, is beset with difficulties as modern agricultural technology was largely developed for temperate areas. Research in situ is necessary if tropical agricultural systems are to yield food surpluses but the lack of skilled technical personnel in tropical countries limits such experimentation from being carried out (Poleman, 1964:155). The remaining chapters will discuss the methods used by the small farm colonists of the Transamazon. In this discussion, the farmers' agricultural production will be examined in relation to their background and the modern innovations which were made available to them.

NOTES

[1] A sizable group lived in the community of Cachoerinha, and individuals from this area were among the early settlers of the Vila Roxa area. Many of their kinfolk followed in time.

[2] In a brief publication on the soils of the Altamira municipio, the soil scientists assert that only transportation difficulties in the region have prevented farmers in this area from exporting sizable surpluses (IPEAN, 1967:43).

[3] This occurred in one instance at kilometers 50 to 60, where colonists did not choose their land but were told to draw lots from a hat to determine their farm sites.

[4] The Hanunóo in the Philippines also use vegetative criteria in evaluating the agronomic potential of an area (Conklin, 1957:39). On the other hand, the Kekchi in Guatemala use color, texture, drainage and root content of soils but also vegetative cover in selecting a site for farming (Carter, 1969:21).

[5] This typology has been developed over an extended period of time and in a series of steps. The four categories above were not used during the actual field work. The first categorization of colonists simply employed their previous state and regions of origin. In fact, the colonists referred to themselves as Bahianos, Sulistas, etc. Region of origin did not, however, help to explain their various behaviors. In the course of examining their approaches to farming, it was noted that certain schemes could be roughly grouped into the four categories of entrepreneurs, independent farmers, artisans, and laborers. When such strategies were compared to the backgrounds of the farmers within each category, it was realized that the farmers who behaved similarly, also had similar backgrounds. It is, therefore, suggested that the above typology might be derived from life history material alone. As such it could be used to select new farmers, as well as evaluate and explain the progress of farmers already in the area.

[6] These ties are usually established during such ritual occasions as weddings, baptisms and graduations.

[7] Gates (1960:247-248), in his careful coverage of farm practices in the United States, refers to European-derived mixed farming. Northern

United States farmers produced their own hay and grain for livestock; meat, eggs, dairy products and vegetables for consumption at home; manure from the barn-kept livestock. Such mixed farming was "fairly representative ... all the way from Maine through New York, Michigan and Wisconsin." Most of the hay was used right on the farm. Women did most of the dairying work. Commercial sale of cheese, milk, or vegetables was common in the period 1815-60 only near metropolitan centers (Gates, 1960:244-267).

[8] This is a role similar to that of the "cultural broker," in Wolf's terms, "individuals who are able to operate both in terms of community-orientation and national oriented expectations" Wolf, 1956:1072). Here it is somewhat different in that many of these entrepreneurs, though not all, are newcomers operating in an area without strong traditional patrons but with strong influence by national economic development plans.

[9] An important volume on the economics of subsistence farmers was edited by Wharton Jr. (1968).

[10] This is the definition used at the International Center for Tropical Agriculture in Cali, Colombia (CIAT, 1974, Program Document). A similar definition has been given by Ruthenberg (1971:6). This is a broad and functional definition and in this category fall widely different types: sweet potato and yam mound-builders of New Guinea (Waddell, 1972); *milpa campesinos* of Mexico and Central America (Carter, 1969; Lewis, 1951; Tax, 1963; Wagley, 1941; Redfield, 1930), ranches in the *llanos* of Colombia (Brunnschweiler, 1972), and large land reform holdings such as those of La Máquina in Guatemala (Frost, 1964).

CHAPTER V

AGRICULTURE IN THE TRANSAMAZON

Slash-and-Burn Agriculture

As in other parts of the tropical world, slash-and-burn agriculture has been the most common method of land preparation in Brazil.[1] Earlier opinions considered this method as primitive and ecologically detrimental (Rocha Penteado, 1970:11-12; Gourou, 1966). Today, however, it still provides the most practical alternative to clearing tropical forests. Even scientific institutions have had to turn to this oldest of techniques to prepare fields for agricultural experiments.

It is a common misconception that slash-and-burn methods are always practiced by primitive farmers on inferior soils. Popenoe's study in Central America (1960) found tropical soils under slash-and-burn cultivation that had high levels of organic matter, low bulk density, high exchange capacities, and high potassium content. These favorable soil qualities are not usually associated with such a method of farming. The study also called attention to the great variability of tropical soils. Sánchez and Buol (1975:598) indicate that tropical soils are comparable to temperate soils in both quality and range of variation. Both high and low base status soils exist in the tropics, as they do in the temperate areas.

Just as tropical soils have proven to be more varied than previously thought, so the ideas surrounding slash-and-burn have undergone equal revision in recent years. Slash-and-burn is emerging in the literature not only as an effective agronomic practice for tropical regions, but also one based on sound economic considerations. In a number of experiments carried out in the Brazilian state of Rio Grande do Sul, burned areas produced 30 percent more than those which were cleared mechanically and cultivated with a plow (Baldanzi, 1959). Burning kills parasites, insects, fungi, nematodes, and pathogenic bacteria. Weeds are destroyed and anaerobic nitrogen-fixing bacteria, such as _Clostridium_ spp. increase their action (Baldanzi, 1959). Anaerobic bacteria, however, are not comparable to aerobic bacteria such as _Azotobacter_ and _Beijerinkia_. The latter are far more important nitrogen-fixers. The ashes decrease soil acidity and this aids the nitrification process in both Brazil and Southeast Asian experiments (Spencer, 1966:33). Burning aids the flocculation of colloids, which as Sioli (1973) points out, are sorely lacking in many tropical soils under natural conditions. The favorable results from Brazil were confirmed in the Peruvian Amazon. Sánchez _et al_. (1974) found that yields using traditional slash-and-burn methods were 50 to 60 percent higher than yields from bulldozer-cleared areas. Sánchez attributes the lower mechanized yields to reduced infiltration resulting from soil compaction, the lack of nutrients from the ash layer, and the loss of the humic horizon by bulldozer scraping.

Equally relevant data on the effects of slash-and-burn was reported for Africa by Nye and Greenland (1960). When the forest is cleared and the vegetation burnt, all nutrients, except nitrogen and sulphur, are deposited as ash. While nitrogen and sulphur are lost as gases, the other elements are washed into the soil with the advent of the rainy season. Heating of the soil leads to increased fertility, largely due to the change in the state of nitrogen mineralization (Nye and Greenland, 1960:72). While the loss of nitrogen, sulfur and carbon[2] are regrettable, the increased fertility and improved conditions for plant growth are not.

Burning eradicates seeds and vegetative material which can lead to a large crop of weeds. Animals and insect pests are also destroyed or driven out by the fire. These particularly beneficial results affect yields. Weed invasion limits crop production not only by its natural competition for soil nutrients but through the accompanying increase in the rodent population. During the early stages of grassland, rodent populations undergo accelerated growth. The damage caused by rodents to young plants can be very severe (Popenoe, 1960:59-62).

In economic terms, burning is also good business. Rodriguez Lima (1956) estimated the cost of machine clearing in a várzea area of the Brazilian Amazon at old Cr$12,574 (US$503) per hectare. The same area could be cleared by machete and hand axe at a cost of Cr$690 (US$100). This includes paying the unusually high salaries operative in the Transamazon region (Cr$15 per day). The only advantage of the bulldozer is that it accomplishes the work of one hectare in six days, as compared to 48 days for the manual method.[3] However, by employing more workers the work could be done in less time (Rodriguez Lima, 1956:59-69). In the Yurimaguas region of Peru, a team of North Carolina agronomists came to a similar conclusion. Depending on the machinery used, mechanical clearing costs varied between US$106 and US$212 per hectare, while manual clearing was only US$53 per hectare (Sánchez et al., 1974).

For populations with low capital resources, and low levels of affordable technology, slash-and-burn is a land preparation technique that is based on sound agronomic and economic judgments (Sánchez and Buol, 1975:601). Slash-and-burn techniques are usually associated with shifting cultivation as a system. Transamazon farmers, however, utilize slash-and-burn techniques of land preparation, but most do not seem to be going in the direction of shifting fields. Rather, the land is kept in permanent production through pasture development and the establishment of permanent tree crops.

Field Measurement

Once a colonist has chosen his lot, his first field needs to be laid out. The area is measured carefully to fulfill both credit requirements and production needs of the farm household. Areas facing the road are cleared first, and each year the new fields move further back in the rectangular 100 hectare landholding. The common basis of measurement is the tarefa or "task," although most farmers are also familiar with the term hectare. The measurement of this area varies with the size of a man's hands and arms. The stick used to plot a field, a braça, is cut to the size of an arms-breadth, or ten palmos in length. The size of a palmo will vary from farmer to farmer, however, most men's hand palms were close to 22 cm. The average braça is 2.2 meters. The Transamazon tarefa is an area slightly smaller than an acre.

At the edge of the prospective field, a long wooden sighting stick or small sapling is placed in the ground, and a "flag" such as a shirt or palm frond is placed at the top. The area around the marker is next cleared of vegetation. Then, using a braça as his measuring stick, the

TABLE 12

COMMON MEASUREMENTS

1 palmo	22 centimeters
1 braça	10 palmos
1 braça	2.2 meters
1 tarefa[a]	3,250 square meters
1 acre	4,000 square meters
1 hectare	2.5 acres
1 hectare	3.08 tarefas
1 hectare	10,000 square meters

[a] A tarefa varies in other parts of Brazil. See Smith (1972) for the various equivalents.

TABLE 13

LABOR INPUTS OF VILA ROXA FARMERS[a]

Activity	Median	Mean	Range
		(In Man-days per Hectare)	
Field Measuring	1.0	1.0	1
Underclearing[b]	5.7	5.9	1-17
Tree Felling[b]	4.0	4.2	1-17
Burning	1.0	1.0	1
Re-Burning	4.8	11.8	1.4[c]-60
Planting[d]	3.4	5.7	1.5[c]-10
Harvesting[e]	3.8	5.6	1.2[c]-18
Financing	12.0	14.2	6-20

[a] Based on a 50 percent sample of Vila Roxa residents.

[b] Laborer-farmers spent more time underclearing (8.13 mean average) and tree felling (6.19 mean average) than other farmers.

[c] These low figures were given by laborers who had neither actually carried out re-burning, nor spent much effort planting and harvesting.

[d] Independent farmers have small, intensively cultivated areas. Their planting inputs are above both the median and the mean, an indication of their intensive approach to farming.

[e] Artisan-farmers worked longer in harvesting activities (7.3 mean average) than other farmers.

farmer starts out from the marker moving in a straight line and makes a trail (picada) with his machete. As he clears the path, he lays the stick on the ground and aligns it with the flagged marker. If the field is meant to be, say 12 tarefas (3.63 hectares), the farmer moves forward down one side of the future field for 100 braças (220 meters). At this point, he places another upright marker in the ground, clears the area around it to improve visibility and turns at a right angle.[4] He then marks off another 75 braças (165 meters), and places a third marker in the same manner as before. Turning another right angle, he marks still another 100 braças. A fourth marker is placed, and the last 75 braças (165 meters) are cut through to the original starting point. The work is slow, because it is difficult to keep the markers in sight and maintain a straight line. The farmer must constantly check his braças' alignment with the flagged markers.

It is almost inevitable that in the course of marking his field, a farmer will run into a large tree that he cannot chop down with his machete. When this occurs, the common procedure is to avoid it, yet not lose one's place in the lined measurement. A few feet away from the tree, the farmer measures a braça towards the inside of the field, then measures a braça forward, and then a braça back to the original line of measurement (See Figure 12). In this manner he is back in a straight line, and the tree serves as new point of alignment instead of the marker. If visibility is not good, he may clear some of the vegetation around the large tree. The time it takes to carry out field measurements varies with the worker, but most farmers in the Transamazon could do a 12 tarefa field (3.63 hectares) as described above in one to two man-days.

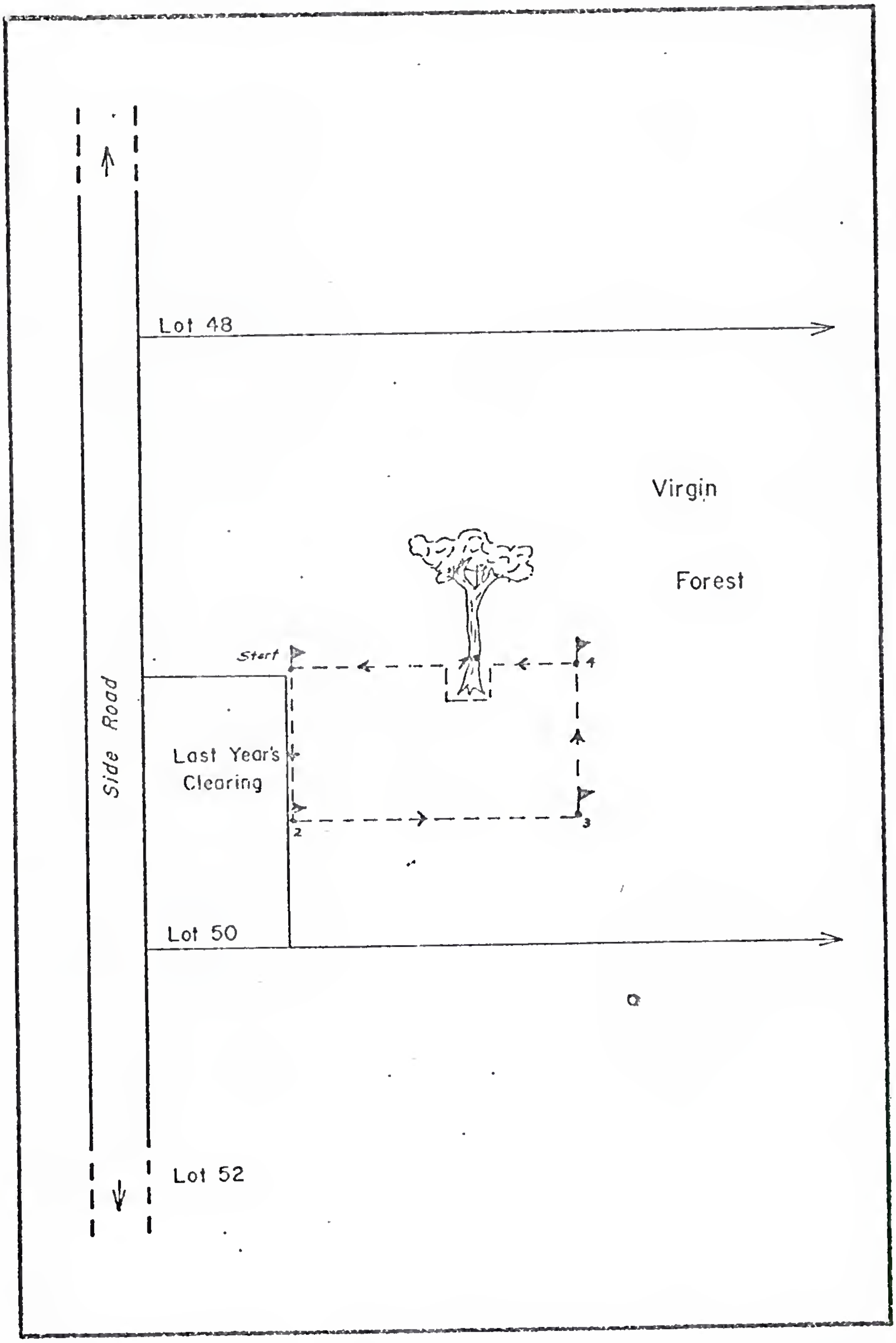


Figure 12. Field Measurement

Underclearing

The process of underclearing or broca is basically done in the same way by all colonists. Caboclos from the Amazon demonstrate a greater ease in using tools and achieve a more even mat of cut vegetation. While caboclos and Northeasterners tend to use the machete (terçado), the Southerners, more often than not, used a foice, a type of long-handled scythe. The work follows a sort of circular pattern which is executed by a single worker, or a pair working in tandem. First, facing the virgin forest, the men clear their way around one side of an obstacle usually a large tres with attached vines or a group of small trees to be felled. They work around to the back of this chosen obstacle. Then, facing the cleared area, they fell the remaining light material so that it falls from the uncut area back into the clearing (See Figure 13). Thus, they prevent brush from falling on top of them, and keep the next uncleared area free of fallen brush. No worker ever observed was hit by falling vegetation unless a number of laborers worked too closely together. Accidents among the non-local population were far more frequent than among caboclos.

The usual cutting pattern for light to medium growth, is to use short two-foot chops close to the ground, which leave four-inch stumps protruding from the ground. While the non-Amazonian colonists allow whole trees to fall into the clearing, caboclos have a somewhat specialized technique which minimizes the risk of falling brush. As the tall trees or a group of entangled vines begin to topple, caboclos use slower but longer strokes (about six feet) to cut the plant in sections as it fell, thereby shortening its falling distance and cutting it in smaller pieces. The worker stands to one side of the large plant as he cuts the root. Then the sideway blows of the machete, plus the initial cut of the tree away

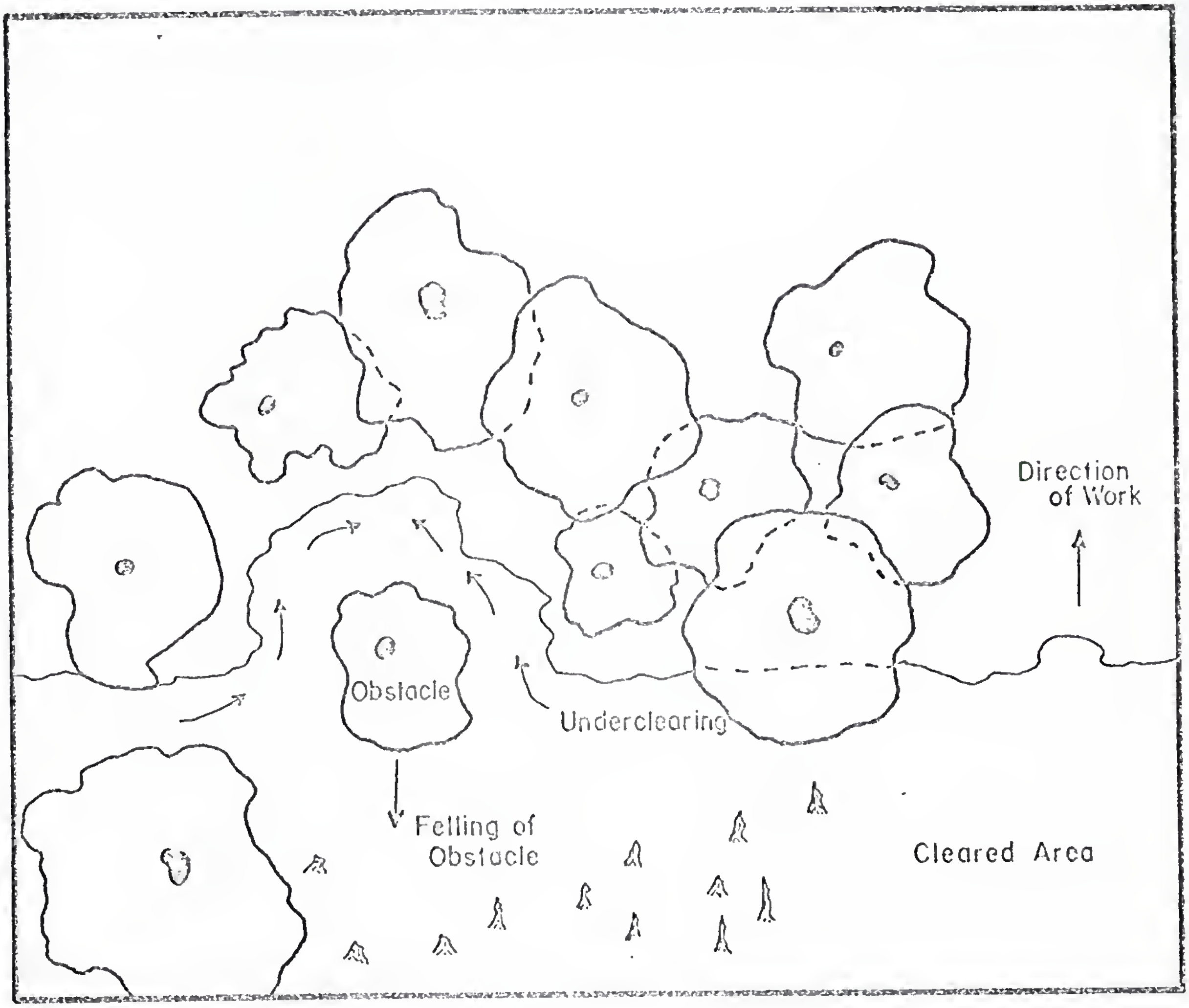


Figure 13. Underclearing Diagram

from the worker, keep the plant from falling in his direction, or the upper branches of the tree from falling on his or any of the other workers' heads. When the task is expertly done, the tree or bush falls almost in exactly the same spot in which it stood. Younger workers are slow in chopping the vegetation in sections as it falls. If a number of young workers work in a line, the number of warning shouts are indicative of unperfected technique. This suggests that it takes several years for a farmer to reach a level of proficiency in underclearing work.

The cutting of interwoven vines also calls for a slightly different technique, especially if the vines are thick. First, the vines are cut through at about arm's height, leaving intact whatever is attached to the ground. Then, cutting downwards on the lower section, the worker uses one or two strokes to whittle it down to the ground, and does this for all the vines in the bunch. Finally, he goes back to cut the hanging tendrils up above head height and leaves the rest dangling from the tree. In this method more than one person can work on a dense bunch of vines until the final step of clearing the upper tendrils, when only one can work. This technique keeps a solid base of the vine steady while cutting the lower sections, which would be harder to do if the vine were first cut through at ground level. Otherwise, long vines will be left swinging and the worker will have to chop at a moving object.

While all colonists use these three techniques to one degree or another, the paraenses are much smoother and efficient in their work. Normally the work of underclearing is not a hazardous task. However, great discomfort can be caused by a razor-sharp plant called _capim cortante_ or _tiririca_, and biting _tachi_ ants.[5] Underclearing begins in June and July, and ends by August. The labor input varies with the type of forest, the size of the clearing, and the farmer himself. The number of man-days needed to clear one hectare ranged from one to seventeen among the Vila Roxa colonists studied. Wagley (1964:68) reports that among the Itá caboclos underclearing took approximately fifteen man-days per hectare.

The underbrush is left to dry for one or two months before the larger trees are felled. Those who quickly finish either of these jobs on their lots earn wages by helping others. An alternative strategy is to clear for others and then catch up on one's own work later. The latter, however, is a risky approach that most prefer to avoid, since many men have waited too long to clear their fields before the coming of the winter rains.

Tree Felling and Burning

Large tree felling, called the derruba, takes place between August and September after the underbrush has dried to form a crisp tinder-like material. Most persons follow a traditional method which directs a large tree to fall on top of the smaller ones which have been partially cut but not toppled. If the area has large buttressed trees this calls for the use of a movable scaffold, or jirau, which is carried from one tree to another. It is saved also for later use in hunting, as an alternative to stringing up one's hammock up in the trees to wait for game.[6] Labor input in tree felling can be high if the forest includes numerous hardwood species. Farmers who choose the more fertile liana forests have a much easier task of tree felling, but a harder job of underclearing. Variation in labor input ranges from one to seventeen man-days per hectare for tree felling.

A number of colonists own powersaws and use them in their own work and to cut trees for others. In most cases of such service, the owner tends to operate his own machine as the bank-financing for the saw requires he take a course to learn how to run it. If a powersaw belongs to one man but is run by someone else, the overall charge tends to be higher, Cr$120 per hectare, as the wages are split between the owner and operator. An excellent operator who owns and operates his own powersaw charges Cr$100 per hectare. The price of the powersaw itself is approximately Cr$5,000 (US$710) and most farmers need to be financed by the bank for such a purchase. The use of powersaws not only does the job more quickly but also alleviates the task of building scaffolds, as the saw can cut through any part of the tree with relative ease. This is the only modern technological innovation utilized by the Transamazon farmers. In general, however, tree felling involves the use of a single-edged steel axe and much back breaking work. After the trees are felled, some farmers gather them into piles, or cut them into smaller sections to ensure a better burn. This, however, entails a much higher input of energy which many farmers are unwilling to undertake. Ideally, the large trees will dry for one to two months before the process of burning the brush begins.

Burning takes place between late October and December, depending on the weather. One waits as long as possible to assure maximum dryness, and the hottest burn. Without a weather service, the difficulty in timing the burning can be well imagined. From early October the conversations turn to the weather, and the slightest cloudiness is watched with concern. A light rain becomes a major topic of discussion for days. It is worth remarking that even in the dry season it still rains on occasion.

This makes it difficult to determine when the threshold for the heavy rains has been reached. Important, too, is the lack of experience of the newcomers. By 1974, most farmers had begun to discuss the weather with local caboclos, but little interchange had ocurred in the previous two years.

The beneficial effects of burning on soil properties and fertility have already been discussed. The burning technique varies a great deal among the colonists, but it usually involves a number of persons who simultaneously circle the cleared area with a homemade torch or burning stick. Some kerosene has been spread at the edge to aid in the spread of the fire. At least five to six days without any rain whatsoever are necessary before attempting to burn. Noon to two p.m. is a preferred time for burning since the sun is at its hottest and the wind is at a minimum. Some colonists use the wind to their benefit if they and their neighbors have cleared several contiguous fields. The fires are started at the edge of one field and carried by the wind across the others. There is little need for a fire-break as the green virgin forest does not burn readily at all (Cf. Carter, 1969:57). The quality of the underclearing to a large extent determines the quality of the burn. Lands with liana forest burn better than those with large buttressed trees, since light, dense underbrush, if properly dried, provides a great amount of kindling for a very hot fire. Large trees hardly burn unless they are sawn into small sections. If the vegetation burns well, a good ash layer remains. If, however, much vegetation remains barely charred and in large pieces (sapecado) a further labor-intensive step is called for, the coivara. This is dirty work, chopping the charred vegetation and making little piles that are then burned individually with the aid of costly kerosene.

The labor input may be higher than all the previous steps put together. Some farmers estimate that it takes up to sixty man-days per hectare. If this step is needed, the farmer usually chooses only a portion of his cleared field to reburn and lets the rest go to weed. Such work may not be completed before the first rains come. The nutrient pool will be small and uneven, the soil more acid, the pests and weeds will be back even before the first year's crops are harvested. Lower yields, and more work is the price that is paid for a bad burn.

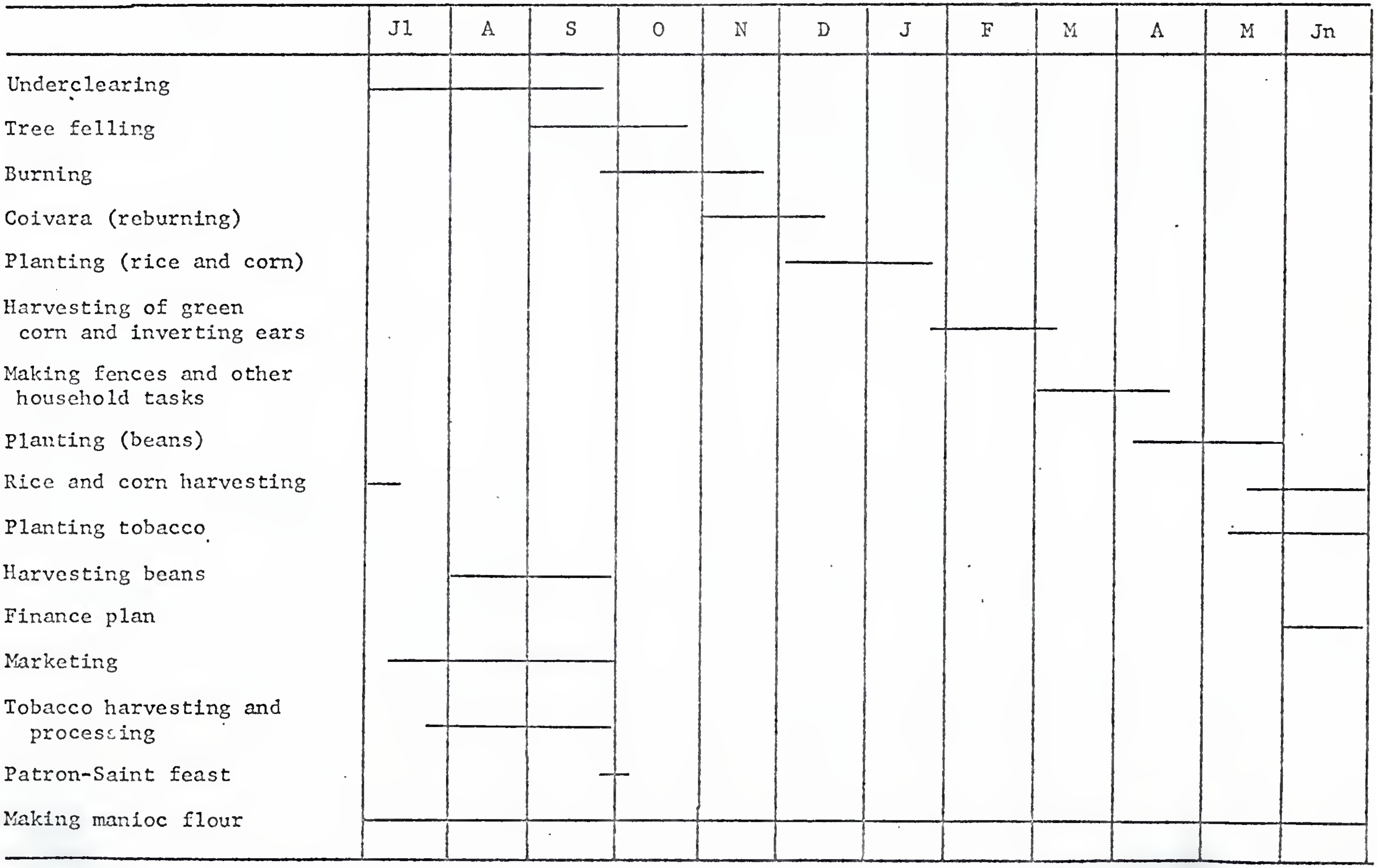
Planting Sequences

In late November and early December, the fields are planted in rice (*Oriza sativa*) and corn (*Zea mays*). Rice is usually planted on well-drained slopes, while corn is planted on the low areas which usually have less surface rock than the weathered slopes. If the soil is poor and/or the field is badly burned (*sapecado*), the farmers immediately plant the area in manioc (*Manihot esculenta* Crantz), which is usually a second-year field cultigen. It is important to have the seeds in the ground before the rainy season gets underway for better weed and pest control. There is also evidence that a nitrate pulse, which lasts about two weeks, follows the start of the rains (Nye and Greenland, 1960:110-111). During this period nitrification is rapid, and the availability of plant absorbable nitrogen is at a peak. Crop yields are likely to be considerably higher if the farmer has acted swiftly to give his crops the advantage of this growth-stimulating nitrogen.

Beans, the third major crop, are planted only after the heavy rains have ceased, and the "dry" season is underway. This occurs sometime

TABLE 14

SCHEDULE OF AGRICULTURAL TASKS



between May and June (See Figures 14 and 15). Each set of seeds is planted at the base of the now dry corn plant. After a small February-March harvest of fresh corn, the top of the stalk is bent over so that the remaining ears may dry. The drying stalk forms a sturdy support for the growing beans. Both are left in the ground and are harvested in their dried forms several months later. Not only does planting in May allow the beans to benefit from the support of the corn plant, it also protects the bean seeds from excessive rainfall which can rot the seed. Farmers who plant early in April are dismayed when they find that few of the seeds have managed to germinate.

The bean varieties which are encouraged by the federal agencies include several varieties of *Phaseolus vulgaris*, such as red beans (*Canário*), black beans (*Rico* EEP 23) and small cream-colored beans (*Jalo*, *Cristal*). In a study by BASA (1971:45), it was felt that the *Phaseolus* varieties, especially the black bean, had better market possibilities. Therefore, farmers received bank financing to plant them. Cowpeas (*Vigna sinensis*) on the other hand, are not financed. These are the beans which have been planted successfully in the North and Northeast, but which have a relatively low market value. Of the above forms the Vila Roxa colonists planted the black bean (*Feijão preto*), *canário*, *jalo*, and cowpea (*Feijão da corda*) varieties.

Planting of rice, corn, and beans is done manually, usually using a simple mechanical device introduced by the colonization agency. This is a hand-operated planter or dibbler, called a *matraca*. The seed container is filled at the top, the point of the chute stuck into the ground, and five to six grains are released when the two-handled tool is clicked together. In this method 20 to 30 kilograms of rice seed are used to plant

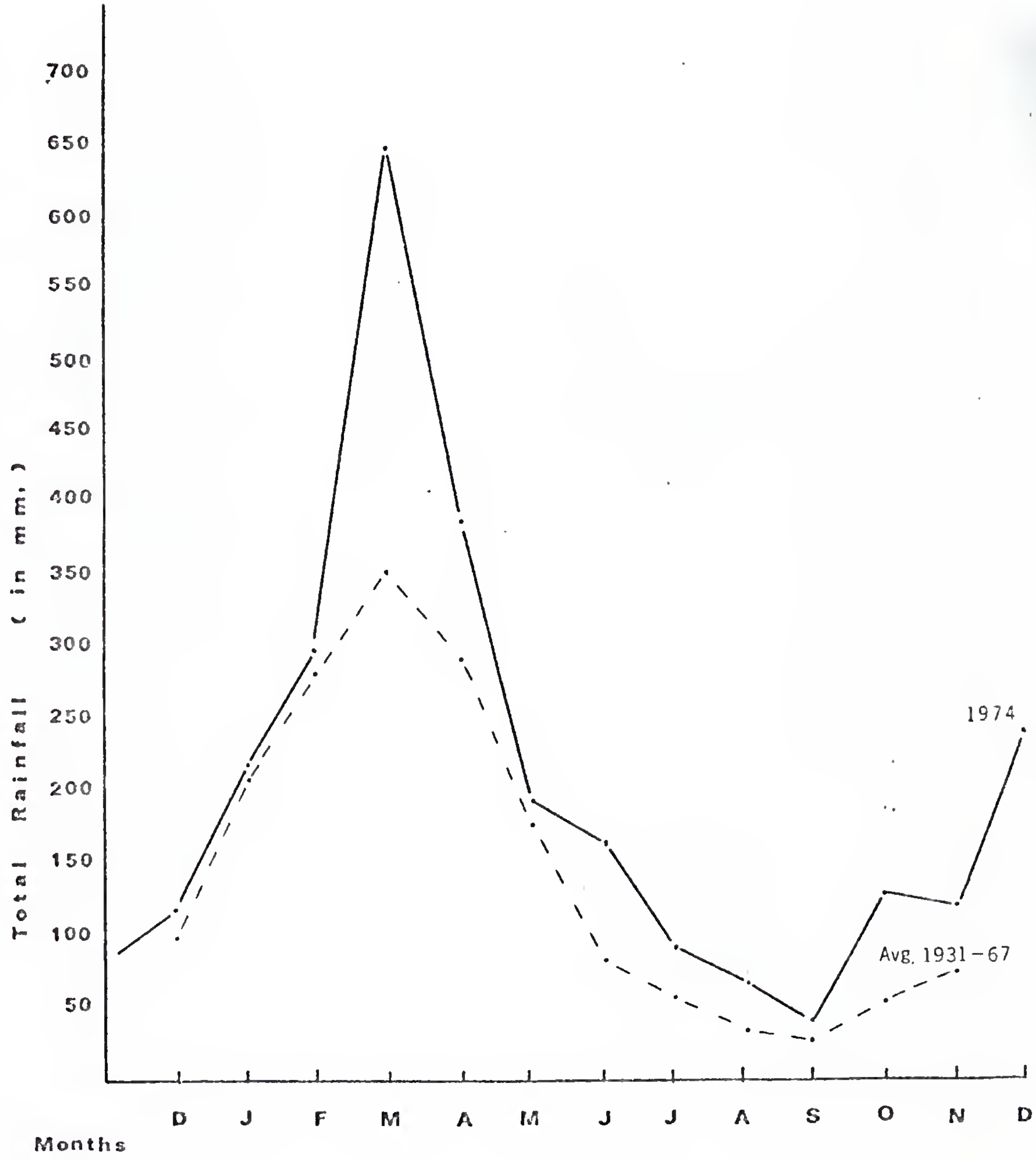


Figure 14. Altamira Rainfall Pattern

Source: Italo Claudio Falesi, Os Solos da Rodovía Transamazônica, 1972.
Emilio Moran, Field Notes, 1973-1974.

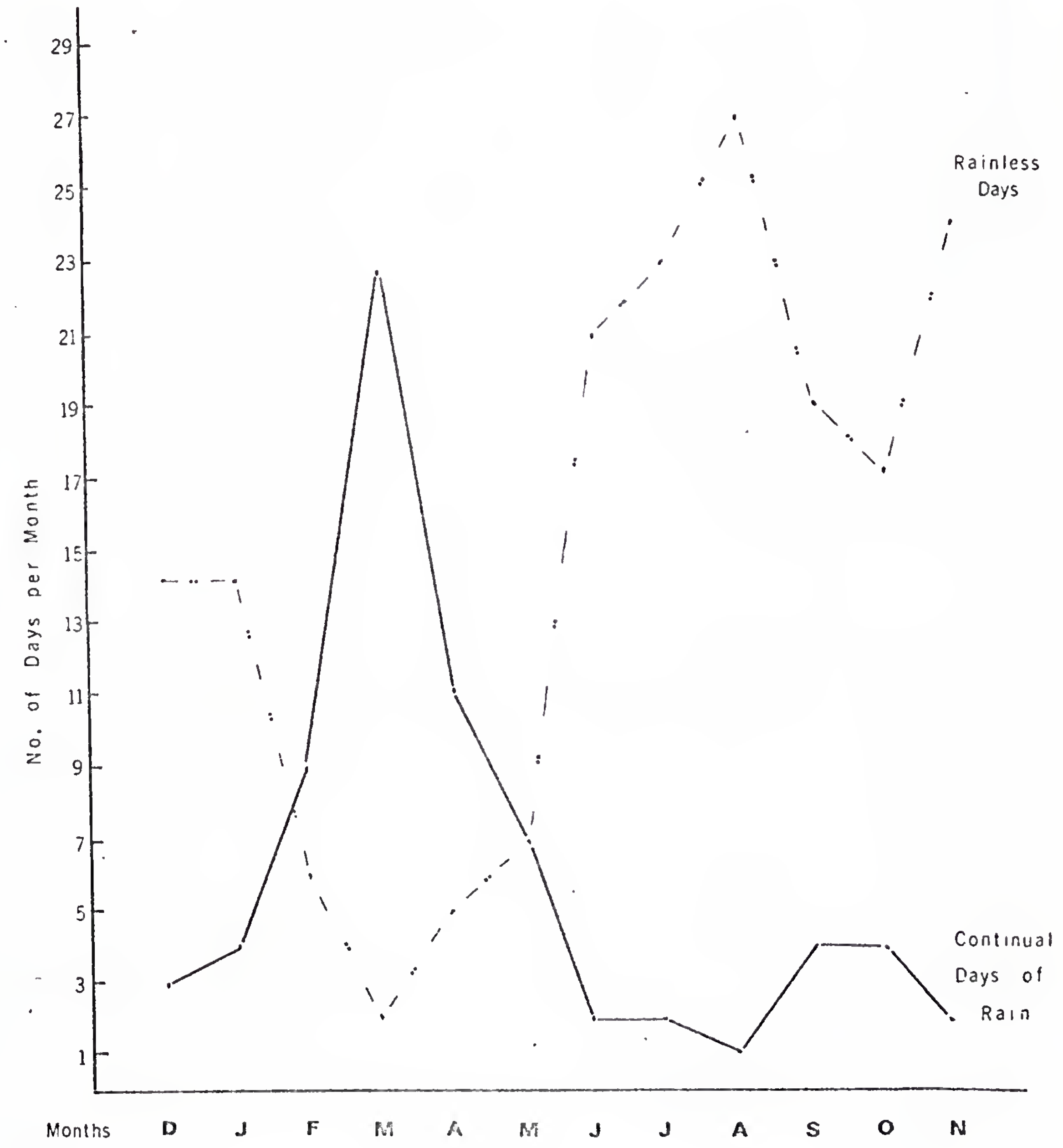


Figure 15. Pattern of Rainless Days and Continual Days of Rain in 1973-1974

one hectare. No one was observed to use a dibble stick, so common in the other areas of the tropics. Manual planting depends on tools such as a machete or a _sacho_. The latter is a curved-handled spade, about 40 centimeters in length, which is traditionally used by rice farmers from the state of Maranhão. The method of planting with a blade or _sacho_ involves more bending, since the farmer must slide the instrument in at an angle, lift a clod of dirt, and manually throw in a handful of seed. The clod falls to cover the seed when the blade is removed. In the manual planting of rice, one often needs ten more kilograms of seed per hectare because the number of grains is not mechanically controlled. In the machine planting of corn, 22 kilograms of seed are used per hectare. Machine planting of beans uses 40 to 50 kilograms per hectare.

Manioc and bananas (_Musa sapientium_), two crops which provide a dense low canopy, are also planted about the same time as rice and corn. These crops are generally planted on "last year's field," as they demand less fertile soil. In general the time of planting of these crops is not as critical as is that of rice, corn and beans. The spacing and acreage of all these crops will depend on the amount of land which is cleared of burned debris, the amount of wage labor available for planting, and, of course, the farmer's experience. On comparable fields, rice bunches are planted 30 to 38 centimeters apart. Between corn stalks, the distance is increased to 65 to 100 centimeters, which allows for the growth of the beans. Manioc is planted 85 to 130 centimeters apart, although the field appears to be much more densely planted, since the varieties used in this area tend to branch and spread. Therefore manioc provides better soil protection than either rice or corn, as it makes a canopy over the soil and shields it from the leaching action of rain.

Some of these major crops are intercropped with other products. Corn, of course, is associated with beans. Bananas may shade cacao (Theobroma cacao), or be planted with tall thin papaya trees (Carica papaya) and low growing pineapples (Ananas sativus).[7] Manioc may be associated with bananas, pasture grasses and sweet manioc varieties planted near the house with fruit trees and vegetables. Lastly, open fields of rice may be sown simultaneously if the farmer feels the soil is too poor to support another year of production. Or he may simply be planning to invest in cattle, and will have a ready-made pasture soon after the rice is harvested. In this system grass takes over immediately to cover the soil. Other farmers may plant grass after crops of manioc and bananas have been planted. The grass seed is sown by the broadcasting method (botar capim). The seed may simply be collected manually from a neighbor's lot, bought for cash from other farmers, or purchased from local supply houses or the experimental station. Most commonly a variety such as colonião or guinea grass (Panicum maximum) is used.

Farmers living on their land plant a great variety of edible plants near their house. Sugar cane and flowers are planted between the front of the house and the access to the road to beautify the approach to the dwelling. Behind the house one finds papaya, collard greens (couve), green peppers, hot peppers, bananas, okra, carurú, guava, tomatoes, and sweet manioc. Spices, seedlings, and medicinal plants are also grown near the house, preferably on raised platforms (jiráu) to protect the plants from ants and chickens. Further away, citrus, jackfruit, pineapple, cashew, squashes, sweet potato, taioba, inhame, mango, tamarind, bitter manioc, and sesame are also grown. However, none of the above cultigens are far from the house, and provide great variation in the household diet. A comprehensive list of plants cultivated by Vila Roxa farmers is found in Appendix 5.

After planting of rice and corn, the heavy rains begin again, giving a relative period of rest and inactivity. The men stay at home a great deal and are reluctant even to visit, since the thick clay mud would be tracked into neighbors' houses. Very little weeding of the fields occurs during the rainy season, even on those fields which had bad burns and consequently vigorous weed invasion. The attitude of many farmers is stoical, "nothing can hold back that bush (mato), there is nothing one can do (não tem jeito)." As a result, weeds compete with crops and probably are greatly responsible for low yields. Several fields had vines and bushes 35 to 45 centimeters in height within a month of the burn. This type of secondary successional vegetation predominates, rather than grasses (Richards, 1964). Only the tallest weeds are lobbed off with a machete as the farmer walked through his field. Such neglect in the rainy season is partially explained by the infestation of tiny gnats, or black flies (Simulidae spp.). Their effect on the health and work performance of the farmers is discussed in Chapter VI.

By the end of the rains the farmers are at their busiest. The rice must be harvested, the beans planted, arrangements made to transport these produce to market, and a plan for next year's financing must be worked out with the extension agents. There is even a celebration of the feast of St. John at this time. Coordinating all of the above is no easy task, especially since the end of the rains also signals the peak season for malaria. Many farmers have to contend with its high fevers and its debilitating side effects (See Chapter VI for data on malaria incidence).

Harvesting and Marketing

Rice is the first crop to be gathered in the harvesting cycle. It is harvested by hand using a sickle or kitchen knife, and is cut 30 to 50 centimeters from the ground. This length of chaff is left if the rice is to be threshed by hand. If, however, the rice will be machine threshed, the grain heads or cachos are cut off at a height of 1.30 to 1.65 meters, so as to leave less straw for the machine to sift. Cutting the rice in cachos involves more labor, and may require 15 to 18 man-days to harvest one hectare. Harvesting the meter-long rice stalks for hand threshing requires only 6 to 9 man-days per hectare to cut and pile. Rice cutting could be faster, but the practice of intercropping with grass slows the process. By the time of the rice harvest, pasture grass surrounds the rice. At other times, farmers also plant manioc and bananas after the rice come up so as to minimize the exposure of the fields and get optimum production in a single season.

Setting up a hand threshing unit takes about three workers a period of some three hours, or approximately one man-day. An area is selected near a large fallen log in the middle of the rice field. The ground about the log is cleared of stumps that may not have burned. Then four holes, two on either side of the log, are dug with a cavadeira, or post-hole digger, to about two feet in depth. The posts are placed in the ground and packed with the remaining dirt. Old burlap sacks are then used to make an open three-sided box. Each of the panels is strengthened by cross-supports tied to the posts with vines (cipó). The rice is then beaten against the log, and falls to the burlap-covered ground. In the process of beating, flying grains are caught by the three-sided shield, and are diverted to the pile in front of the thresher.

Machine threshing is a much swifter operation, but is not cheap in economical terms. First it takes about four times as long to cut the rice in small cachos as it does to cut the whole stalk. Second, one has to wait for a day when the thresher will be available, arranging for the gasoline, and hiring more people. To run the thresher efficiently takes a minimum of five people: one or two to feed the rice into the machine, one to operate it, one to keep the chaff exit clear, and usually two young workers to keep sacking the rice as it comes out. The farmer is expected to pay Cr$2 per finished sack of rice for the use of the machine and feed the government employed operator during the day. The speed of the thresher depends on many factors. The machine must be in good working order; the workers must set up an efficient feeding operation, and the amount of chaff the machine handles should be minimal. Such operations vary from a low of 35 to a high of 130 sacks threshed in a full work day. Obviously, it is hard to generalize. However, except in cases where a farmer needs to get a very large crop to market before it spoils, hand threshing seems to serve just as well or better than machine threshing.

Rice yields vary a great deal. In 1972-73, a selected seed from the Northeastern state of Pernambuco was introduced to the farmers by the colonization Agency. The seed was not well adapted to the area. The germination levels were low; the rice underdeveloped. While other seed types such as canela de ferro, IAC 1246, and "101" were useful in the area, and available to the farmers, the colonists felt obliged to use INCRA-promoted rice. The yields of the poor seed were extremely low. As rice was the best producing commodity and used to pay bank and INCRA debts, the farmers were greatly distressed. Fortunately the rice seed used the following year produced good yields, despite the fact that a sizable number of the fields had not burned well during the clearing process. At this time the greatest problems of the rice production involve competition with weeds, especially Elensine indica, Digitaria horizontalis, Emilia coccinea, and Althernanthera ficoilea (IPEAN, 1973a). Also two diseases affected the crops, "bruzone" (Piriculoria oryzea) and Helmisthosporium oryzea. The average rice yields in 1973-74 gave 597 kilograms per hectare (See Table 15).

The small difference between the average yields for 1972 and those for 1973 shows the debilitating effects of poor seed quality and poor clearing. When compared to the 1053 kilograms produced per hectare in 1971, the possibilities for rice production do not seem as bleak. Better yields can be produced. It may be well to point out that the declining yields are probably not affected by declining soil fertility, since each rice crop is grown on a newly cleared field.

A main problem with the rice crop in the Transamazon is the difficulty of getting it out. Except for farmers who have lots along the main highway and the few good side roads, most of the colonists have difficulty in getting the sacked rice out to market. Sometines it is carried by mule one or two sacks at a time, which is a slow and expensive process. If the farmer must borrow a mule, he must give his neighbor one sack of rice out of every four taken to the main highway.

Rice storage is also a problem. Some production is lost when colonists cannot get the sacks to the main highway and try to store them in makeshift shelters on their lot. Here the stores are subject to rat and pest infestation. High humidity causes molding. It also lowers the

TABLE 15

VILA ROXA RICE PRODUCTION

Date	Number of Farmers with Production	Average Yields in Kilograms per Hectare	Number of Farmers with no Production *
1973-74	17	597	8
1972-73	15	534	5
1971-72	10	1053	1

*The most common reason given for total absence of production in 1972-73 was the bad rice seed; in 1973-74 it was inadequate burns.

market value of the unshelled rice since humidity causes rice to break and shatter during milling. If a colonist manages to get his rice as far as Vila Roxa he rarely stores the rice in the communal warehouse (silo), for that warehouse has neither security nor adequate accounting procedures. Instead he stores the unmilled rice in his home, where it is again subject to losses from the rat population. It seems the rats are even more attracted by unshelled rice than the milled, household variety.

Rice is generally marketed through COBAL-CIBRAZEM, especially if the person has a debt to pay to the Bank of Brazil. In this system, the farmer's debt is deducted from the total value of his production, and the person is reasonably assured of continuing good credit. Prices paid by COBAL-CIBRAZEM, however, are considerably lower than those from the private entrepreneurs of Altamira and the Vila Roxa area. The former usually retrieve the produce from the farmer's lot, give him the sacks for his rice, and pay him cash on the spot. This frees the farmer from paying Cr$4 for each burlap sack, and the transportation costs of nearly Cr$10 per sack to take the produce into town. In 1973-74 COBAL-CIBRAZEM paid Cr$53 per 60 kilogram-sack of rice, as did the Altamira dealers. However, discounting the cost of transport and bags, the net price was actually Cr$39 per sack if sold to CIBRAZEM. The local brokers near Vila Roxa paid Cr$50 per sack, picked up the production from the farmers' land, but did not always provide the burlap bags. Others supply the sacks to guarantee a commitment of the harvest. Except for those who feel obliged by the federal institutions to sell to CIBRAZEM, most producers were opting for the better prices and services of the private sector by 1974.

Corn makes up the second most important crop in terms of the number of sacks that are sold in the Altamira market. However, its market value, Cr$30 per sack is less than that given for either rice or beans. Relatively little corn actually reaches the Altamira market, for the colonists generally use the small amount that is produced for home consumption. The yields are affected by the lizard "lagarta militar"[8] (Spodoptera frugiperda), by fungus Puccinea polysora, and spotting, caused by Helminthosporium turcicum.

Green or fresh corn on the cob is used during the months of February and March. It is roasted over coals as milho assado, or processed into corn puddings and a form similar to the Mexican tamal.[9] The rest of the corn is left to dry on the stalks and is harvested with the beans in August or September. The corn yields have been extremely low, roughly 400 kilograms per hectare. In the few cases where two crops of corn are planted in a single year, one in December, and a second in June, the total yields are increased. However, the quality of the ears has been unimpressive, despite the use of hybrids such as "Azteca" and "Central-Mex." The corn grows to a height of 2.5 meters, and normally produced one ear per stalk.

This meager production of dried corn is generally used by the farmers for poultry or corn meal. The corn meal is either ground at a small local mill or processed manually with a mortar and pestle. If a farmer has a small surplus of dried corn he will sell a few sacks to his neighbor. Rarely is the corn production ever used to pay off bank debts by selling it to CIBRAZEM. Only one in five Vila Roxa farmers have enough corn to sell in the market.

Beans, like corn, are not sold in the market as often as is rice. In fact no farmer in Vila Roxa sold beans in Altamira during 1973. The bean production was so low that most families gained only 174 kilograms from the whole bean harvest. In the majority of cases this amount did not even meet the needs of family consumption, and the families had to buy extra supplies in Altamira. Only one farmer had a small surplus of beans, and he sold it locally.

One of the principal reasons for this low production is the damage caused by a fungus growth (Thanatephorus cucumeris). The farmers refer to this as the queima, since the leaves take on a burned appearance. The types of beans which are most affected by this fungus are the Phaseolus varieties mentioned earlier. These are widely planted by farmers because they are encouraged by the bank. They are also culturally preferred. A similar description of fungal damage to Phaseolus is given by Carter in his study of the lowland Guatemala community of Chichipate (1969:69). The cowpea, however, is more resistant to spore growth, as is shown by its widespread use throughout the Amazon.

While the other varieties can be successfully grown during a long, dry summer period, they quickly succumb to the fungus if summer rains appear. Given the unpredictability of summer rainfall, it would seem that current Phaseolus varieties will continually be threatened in the Amazonian environment. However, the native cowpea or feijão da corda could provide a more secure and consistent bean production, important as an added source of protein. Cowpeas are also already adapted to the low base status soils of the area (Sánchez and Buol, 1975:602).[10] The combined average yields of all bean varieties is about 144 kilograms per hectare, in 1973. If one includes all the farmers who lose their bean crops, the average is lowered to 88 kilograms per hectare.

Aside from the factors of climate, seed variation, and natural decimation by pests, the production of crops also seems to be related to the background of each of the four groups of colonists. Their migratory history, the inputs of family labor, and their area of origin are all aspects which have an effect on farm management and production.

For instance, the fewer the number of previous migrations, the better the yields of a farmer tend to be in the Transamazon (See Figure 16). As indicated earlier, entrepreneurs and independent small farmers are both characterized by low rates of migration. From Table 17, we can see that entrepreneurs in the Transamazon generally tend towards cattle ranching and pasture development. Independent farmers emerge as the

TABLE 16

PRODUCTION LEVELS OF CORN, BEANS, AND RICE FOR VILA ROXA FARMERS[a]

Combined Yields per Hectare	1971-1972 Number of Farmers	1972-1973 Number of Farmers	1973-1974 Number of Farmers	Average Yields per Hectare 1973-1974
No production	1	4	9[b]	-
1-500 kg.	2	7	6	202 kg.
501-1000 kg.	6	6	4	777 kg.
1000 kg. up	2	2	6	1432 kg.
Total Producers	11[c]	19[c]	25	

[a] Based on 50% sample of village residents in 1973-74.

[b] This increase is associated with the abandonment of farm management by the laborer-farmer group. They now spend more of their time working in the land of others. The bad seed of 1972 and the early rains of 1973 combined to turn this group's main efforts to wage labor, rather than labor on their own farms.

[c] Not all of the 25 farmers had arrived in Vila Roxa for the first two cropping seasons.

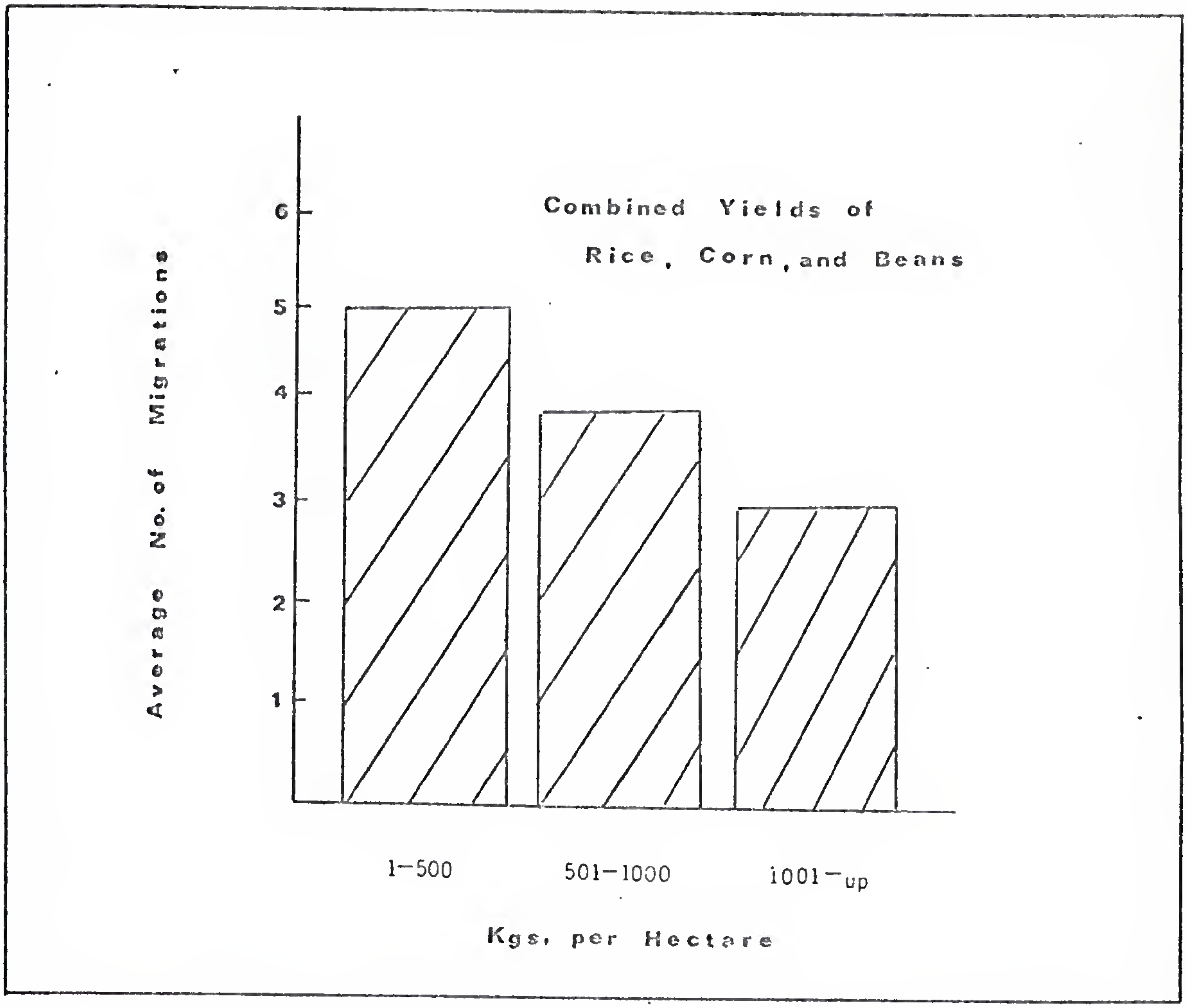


Figure 16. Relationship Between Migration and Farm Productivity

TABLE 17

RELATIONSHIP OF MIGRATIONS ON PRODUCTIVITY AND INCOME[a]

	Entrepreneurs	Independent Farmers	Artisans	Laborers
Average Number of Migrations	1.5	2.1	4.8	5.3
Area Cleared in 1973-1974 (In hectares)	10	2.56	5.8	1.9
Average Yield per Hectare 1973-1974 (In kilograms per Hectare)	Pasture[b]	804.7	503.3	238.3
Average Gross Income per Year from Farm Production 1971-1974 (In Cr$)	20,000[b]	8,798	3,752	2,666

[a] Based on a 50% sample of Vila Roxa residents.

[b] While by 1973-1974 entrepreneurs in the Vila Roxa area were fully dedicated to pastures and cattle, their yields in earlier years were excellent. For example, in 1971-1972, a local entrepreneur obtained an average of 1,200 kilograms per hectare in 20 hectares planted.

group with the highest total farm production, as well as the greatest output of corn, beans, and rice per unit of cultivated land. This suggests that agriculturalists who migrate infrequently tend to achieve more farming success than those who keep moving. Many independent farmers previously owned their own land or worked in decision-making positions, such as that of foreman. Perhaps the long periods spent in such positions resulted in the accumulation of farm management experience which is now evident in their Transamazon productivity. Table 17 points out that independent farmers tend to clear relatively small areas of land in the Transamazon that could be managed easily.

A partial explanation of the independent farmer's better production seems to be these individuals' greater use of family members as a source of farm labor. This influences their total farm income in that, unlike the other three groups, few funds are expended for hired labor. Seven out of nine independent farmers have at least one full-time family member engaged in farm work, usually a young male or their spouse. The farmer and the grown sons work at the heavy tasks of underclearing and tree felling. The wife and younger children are in charge of meal preparations, care of livestock, vegetable gardening, and field tasks such as planting and harvesting. While the family of the laborer-farmer group also helps in farm work, their contribution was sporadic rather than regular and continual. In fact, it is rare to find anyone other than the family head and hired laborers working at the lots of the other three groups. One hears frequent complaints that it was hard to get a full day's work out of hired men; from this it may be inferred that the independent farmer can elicit more labor from his own family members, with no need for cash outlay.

Among the independent farmers, the total farm income was also related to whether the farmer was caboclo or a newcomer. The better use of the land and its resources by caboclos is evident when a larger, more representative sample is used. In the 101 farm management surveys obtained in the region, caboclos had nearly twice the productivity per hectare than outsiders. For 1973-74, the value of corn, rice and bean production of these local people was Cr$808 per hectare, while it was only Cr$494 per hectare for newcomers. The highest yields in the Vila Roxa sample were obtained by an independent farmer who was native to the area. His rice yields were 1,440 kilograms per hectare, and bean yields 1,520 kilograms per hectare. This is far above yields obtained by other members of the independent farmer group, and may reflect his more judicious choice of good soil, his knowledge of the peculiarities of Amazon weather, and his knowledge of the plant and animal resources of the area. Such knowledge lowers one's cash outlay for food items, and consequently leads to a higher net income.

Lastly, the caboclo independent farmers cultivate their fields intensively, not only with food crops for home use, but also with cash crops. Production of farm items other than rice, corn, and beans points to the preference by caboclos in farm diversification. For 1973-74, caboclos in the 101 interviewed sample taken along the Transamazon, averaged Cr$3,370 per household from the production of manioc flour, home-cured tobacco, and the sale of milk, eggs, pigs and chickens. Outsiders averaged only Cr$1,968 per household.

Even before the rice and corn have been harvested, other crops such as manioc, bananas, various root crops, and tobacco are planted by the caboclos. This keeps the land both in constant production and continuously protected. The sale of manioc flour and long coils of cured tobacco brings extra cash for caboclo families. One-third of a hectare solidly planted in tobacco can earn a family up to Cr$6,000.[11] These itensified farming methods also involve smaller amounts of land. In 1973-74 the average area cleared by caboclos was 6.3 hectares, in contrast to 8.0 hectares for outsiders.

Other independent farmers have been acquiring familiarity with caboclo farm strategies, including the use of wild game and wild fruits, to supplement their diets and lower expenses. All independent farmers in Vila Roxa have learned since arrival the vegetation criteria for the choice of good agricultural land. Presumably, they will use this knowledge in future land management practices. The making of coarse, Amazonian manioc flour has been adopted by half of the Vila Roxa independent farmers and a few of the artisans and laborers. While their investment in cattle is still small, all independent farmers raise poultry and swine for both market and consumption. The presence of a caboclo population in the area is beneficial. Their familiarity with the physical environment facilitates the dissemination of such knowledge among newcomers, particularly among the independent farmer and laborer-farmer groups. Artisan-farmers and entrepreneurs, both working at a higher level of income, and using non-farm skills to obtain income, are less affected by the caboclo knowledge of the area, although they do not escape its influence.

Pastures and Cattle

Transamazon farmers can do little to control the crop pests and diseases. Insecticides and herbicides are beyond their means and little is known of the required doses to effectively control local species. The Transamazon experimental station near Vila Roxa has begun treatments but normal doses have at times failed to control the local weed invaders. It is perhaps this, more than anything else, that makes Transamazon farmers look to pasture development as the solution to their pest and weed problems. "Successful" farmers tend to go in the direction of cattle ranching rather than cropping. This "demonstration effect" supports the smaller farmer's conception that "cereals do not give results," and that to have a successful future one must establish pasture.

The two major pasture grasses that have been established in the Transamazon are "Colonião" (Panicum maximum) and "Elefante" (Pennisetum purpureum). Experimental work is proceeding with "Jaraguá" (Hypannhenia rufa), "Gordura" (Melinis minutiflora), "Canarana" (Echonochcloa pyramidalis) and "Kudzú Tropical" (Pueraria spp.). Most Transamazon farmers have a simplistic idea of what it takes to establish a high quality pasture. In their mind, all one needs to do is broadcast the seed (botar capim) and then encourage dense growth by periodic burning. Burning helps control weeds, fertilizes the grass, and ensures a lusher growth. But a look at most pastures in the area indicates that secondary or weed growth appears everywhere. Thus, cattle productivity is likely to be low despite outstanding potential of the region for cattle ranching.[12]

Cattle in the Transamazon are bought from either the State Department of Agriculture (SAGRI) or from other ranchers in the region. One local farmer goes as far as Santarém to buy cattle from Lower Amazon region ranchers. The cattle are mainly for beef production, although a certain amount of dairying goes on as well. Most of the beef cattle are a mixture of Indian Brahma and native creole stocks. This combination is locally referred as Gir cattle, and technically should represent a mixture of one-half to three-quarters Brahma blood. A few farmers have holandesas or a mixed-Holstein breed for dairying purposes, but as yet these are very rare. Cattle are largely managed and owned by persons with previous cattle experience, such as vaqueiros (cowboys) from the Northeast and ranchers from the Central-West states. While most Northeastern sharecroppers have neither the capital nor the experience to handle cattle, the Northeastern cowboys have a profitable arrangement with their boss. Normally, every fourth calf born was theirs, and they got paid a regular wage besides. If the boss has good cattle, and the droughts do not strike, cowboys can afford in a number of years to sell some of their cattle and buy land to start their own operation. Some came to invest in the Transamazon rather than in the Northeast.

In 1974 an increasing number of small-ranch owners were coming from other areas of Brazil to the Transamazon. They are coming to buy land (400 hectares and up) in the small farm belt, and hope to establish cattle ranches. Because they are bringing superior financial resources, it is possible that these persons will succeed in productive pasture development. Previous owners came with capital and got started right away. They usually employ persons from the same area of origin "who know cattle."

Independent small farmers have started owning cattle because they established areas in pasture quickly and when ranchers came, their cattle was put to graze on independent farmers' land. The common arrangement in these situations is that either every other calf born belongs to the pasture-owner--a far more profitable arrangement than that in the Northeast--or rent is paid at a rate of Cr$40 per tarefa per month (US $20 per hectare per month). While this arrangement is short lived, a number of farmers have acquired three or four calves or added income without having to spend any personal capital. These few calves provide milk and curdled milk for the family. Some of the milk is sold locally. Keeping such a small number of cattle does not tax the resources of small farmers. A herd larger than ten head, however, requires a substantial investment in barbed wire, fence posts, and a much larger area to keep free of secondary successional species. The local agronomists have identified a number of plants that can harm cattle if allowed to invade the pasture (See Table 18).

TABLE 18

NATIVE TOXIC WEEDS THAT COMMONLY INVADE PASTURES

Salsa	Ipomoea asarifolia
Samambaia	Pteridium aquilinum
Maniva de Veado	Manihot quinquepartita
Canudo	Ipomoea fistulosa
Erva	Ipomoea tiliaceae
Erva	Tragia bahiensis
Erva Roxa	Cephaelis colorata

Source: IPEAN, 1973b.

In the short period of three years since the Transamazon project began there has not been time for the final direction of cattle ranching and pasture development to be definitively established. It is but a handful of farmers that have had the time and capital resources to establish sizable pastures and purchase needed cattle. Nevertheless, those who have reached herds of 30 to 50 cattle use farming only as a means to clearing new land. A crop is planted to take advantage of the optimum soil conditions, but pasture seed is sown along with cereals. Those who succeed in clearing their 100 hectares will request more land, or buy neighbors' land.[13] Some of the more recent arrivals have bought three to five lots of 100 hectares each. They will be needing more land if they meet with success. The pattern that seems to be emerging in the area is for the side-by-side existence of medium or small ranches with small independent farmers growing crops. Both of these groups, in turn, hire the artisans and laborers for specific skilled and unskilled tasks. Examples of mixed farming occur but they are somewhat rare. They seem to be more common among farmers of German extraction found in the highway strip between kilometer 80 and 110 (Altamira-Itaituba).

Having discussed some of the general agricultural and ranching practices in the Transamazon, it is necessary to point out that such practices are not homogeneous. While most farmers follow the practices outlined earlier in this chapter, the various ways in which the four types of small farmers operate their farms are discussed in Chapter VII. In that section emphasis is placed not on the agricultural activities per se but in their organization as a set of strategies to meet the subsistence and cash needs of the households.

NOTES

[1] Some of the other terms that refer to this widespread agricultural system are "fire agriculture," "swidden agriculture," "milpa agriculture," kaingin, chena and ladang (Popenoe, 1960:4).

[2] Carbon is lost when the litter layer is destroyed by burning and the soil is exposed to the action of water and sun. Humus decomposition increases as a result of aeration, and surface conditions can deteriorate rapidly unless a crop quick to provide soil cover has been planted. The growth of crops and the development of secondary succession hold in check this process.

[3] These figures are high due to the denseness of floodplain vegetation and the heavy labor requirement to carry out ring-barking of the larger trees.

[4] One farmer was known to use an architect's triangle (esquadra) to do this accurately.

[5] Identification of this plant was not obtained, nor of the ants.

[6] Hunting is discussed in Chapter VII in treating of the colonists' use of the physical environment.

[7] In Itá, bananas are associated with corn (Wagley, personal communication, 1975).

[8] This common lizard of the Altamira area causes leaf damage and consumes seeds planted.

[9] The fresh corn-pudding forms included canjica, a sweet dessert made from the fresh kernel pulp, which has been strained to remove the kernel skins. This is cooked down with sugar and cinammon to form a sliceable paste. Angú is made with similar ingredients except that the kernel skins are left in and the mixture has more of a pudding consistency. The tamal form called pamonha is made with salt instead of sugar, and is boiled in a corn husk wrapper.

[10] The latter is also true of manioc, sweet potatoes, and certain varieties of dry or upland rice--all of which are native to tropical environments (Sánchez and Buol, 1975:602).

[11] Compare with Cr$300 earnings from the same area in rice, figuring on a yield of 1000 kilograms per hectare.

[12] Sutmoller _et al._ (1966) have pointed out that serious malnutrition has been found in Amazon valley livestock. Mineral deficiencies have been noted that caused spontaneous fractures in the hind legs. Instances of potassium and manganese are low, and serious defficiencies of phosphorus, sodium, copper and cobalt keep reproductive levels and carcass weights low.

[13] While sale of lots was not permitted, newcomers paid owners a given amount and then they would pick up the lot from the bank, where the previous owner turned in his temporary title. The new owner is usually expected to assume the debts accumulated by the previous owner.

CHAPTER VI

CONSTRAINTS TO AGRICULTURAL PRODUCTION

Selection Criteria and Agricultural Performance

Numerous assumptions based on widely held beliefs and biases were incorporated into the blueprints of Transamazon colonization. Among these were the relation between region of origin and likelihood of success, the necessity of education for pioneer progress, and the importance of previous agricultural experience. Such assumptions were set up as major criteria for the selection of colonists. First, and perhaps most pervasive, was the belief that rural Northeasterners were landless peasants with a low level of technological skill, a low level of education, and a tendency for shiftless wandering. About the only positive thing that popular stereotypes have to say about the Northeasterners is that he is hard-working and long-suffering. The non-indigenous Amazon population, were not part of the colonization plans, since it was believed that they were illiterate, lazy, and preferred to hunt wild game rather than farm the land. In contrast, Southerners were incorporated into the colonization plan under the assumption that they would serve as a "demonstration effect." That is, they would teach, by example, the more advanced agricultural methods used in southern Brazil (Ministério da Agricultura, 1972a:203). The government projected that the colonist population to be made up of 75 percent Northeasterners and 25 percent Southerners. Such population predictions, however, have fallen wide from their mark, as is readily shown by Table 19.

TABLE 19

REGIONS OF ORIGIN OF SETTLERS IN PROJECT ALTAMIRA[a]

	Actual	Projected
Amazon Region	34%	0
Northeast Region	30%	75%
Center-West Region	13%	0
South Region	23%	25%
Total	100%	100%

[a] Based on a total population of 3095 families in the Altamira Project.

Source: INCRA, Secretaria de Planejamento, letter of February 6, 1975. Ministério da Agricultura, 1972a.

By "Southerners" the government usually implied either the *gaúchos* of Rio Grande do Sul and Santa Catarina or the aggressive *paulistas* of São Paulo. The *gaúchos*, often of German descent, have an agricultural tradition that is appreciated by urban Brazilians. Their farms are attractive to the eye and rich in ethnic details. All German immigrants, however, are not good farmers. Willems, a noted student of German immigrants in Brazil, feels that Germans are among the best and the worst of farmers in Brazil (1975, personal communication). While a sizable group of highly successful *gaúchos* are found in Kilometers 80 to 110 of the Altamira-Itaituba stretch of the Transamazon, they are only 4 percent of the colonists and their success may largely be related to their having the best soils found in the Brazilian Amazon. *Paulistas* represent only 2 percent of the population in the major colonization project.[1]

The bulk of "Southerners" are in fact ex-Northeasterners who went to Paraná as young men and women looking for economic opportunity. A few found it and stayed, the rest sought a new haven and found the Transamazon offer attractive. Southern success has not been dramatic. A few Southerners, just like a few Northeasterners, Northerners, and Central-Western farmers, have thrived and are becoming leaders in their communities. For example, the president of an incipient cooperative is from the southern state of Rio Grande do Sul. His vice-president is a Northeasterner. But the Southern colonists are no better, and no worse, than those of other regions. They are hard working but demonstrate a propensity to overextend themselves. They clear areas too large to manage adequately. They over-emphasize cash cropping to the neglect of a diversified subsistence garden. Translated into economic terms, the Southerners are deeper into debt than others, and are more likely to adopt the ways of Northerners and Northeasterners than viceversa.

It was assumed by government planners that agricultural performance of the colonists would follow the stereotypical behaviors of the various regions. While the Southerners may fulfill the expectation of their being hard workers because they have cleared a good bit more acreage than the average each year, this is most probably a function of the sizable bank loans which they received (See Table 20). On the average, Southerners apply for and receive the largest loans of any of the regional groups. In regards to the use of modern farm technology, hardly any of the colonists use fertilizers, insecticides, or herbicides. The only important technological innovation in Transamazon farming is the use of powersaws to clear the forest. As Table 20 indicates, it is the local Amazonian population which first made use of this device, rather than the

TABLE 20

INDICATORS OF SUCCESSFUL FARM MANAGEMENT

	North	Northeast	Central-West	South
Average number of hired labor*	1.4	2.0	3.8	1.0
% didn't hire laborers	47%	47%	55%	21%
Average area cleared per household 1971-1972 (in hectares)	8.75	4.5	5.0	15.9
Average area cleared per household 1972-1973 (in hectares)	6.46	7.0	5.25	8.0
Average area cleared per household 1973-1974 (in hectares)	6.3	8.0	7.1	9.0
Average productivity** per hectare in Cr$ 1971-1972	324.68	716.89	177.78	356.79
Average productivity per hectare in Cr$ 1972-1973	471.83	494.57	253.90	594.38
Average Productivity per hectare in Cr$ 1973-1974	807.62	433.00	361.97	687.22
% in each regional group who own powersaws	25%	20%	27%	17%
% of total power-saw owners	41%	27%	14%	18%
Average debt with bank in Cr$ 1971-1974	4,742	6,003	3,355	6,931
% per regional group with no bank debts	20%	13%	36%	8%

*There is no significant difference in the size of the male labor force between regions (1.65 N, 1.75 NE, 1.09 C-W, 1.91 S).

**"Productivity per hectare" will only refer to the production of rice, corn and beans.

stereotypically "innovative" Southerners. The caboclos own 41 percent of all the powersaws in the area. It would seem then that the Southerners are not applying their credit to the improvement of farm technology. Even their increasing productivity does not suggest that the Southerners are greatly superior farmers. Table 20 clearly indicates that while the Southerners' productivity per hectare has steadily increased from Cr$356.79 to Cr$687.22 (between 1972 and 1974), they are not alone in this feat. Northerners and Central-West farmers have also improved each year.

On the other hand, the "lazy" Northerners, who supposedly preferred jaguar-hunting to farming, are impressive in their agricultural performance. As was previously shown, they have a new clearing technology which has come with the highway. They have had the highest yields per hectare of any region, and have earned consistently higher wages than persons from other regions. Their income from the sale of crops and other farm produce (e.g., eggs, milk, manioc flour, tobacco, meat, etc.) is over twice that of Northeasterners, and over a thousand cruzeiros above that of Southerners and Central-Westerners. Due to their relative lack of cattle, their total liquid assets are the lowest of any regional group. Also operative in this low level of liquid assets, is the relatively low debt owed by Northerners to the Bank of Brazil. Unlike some of the other regional groups, little of the bank funding is used for durable household goods. Only the farmers from the Central-West region have a lower rate of debt. In this latter case, the farmers are relative new-comers to the Transamazon and have been fortunate to bring a good deal of capital with them. Therefore, they do not need to rely as much on loans to work the land. Having a ready supply of cash also helps to explain why the Central-West farmers use far more wage laborers on their farms, an average of 3.8 persons on a full-time basis. They can then afford to catch up in their production in a relatively short period of time.

The Central-West farmers formed the smallest group of farmers. Their numbers are slowly growing, but the Central-West Region, a frontier in itself, has only a small number of persons to "export." Their economic performance has not been impressive to date, but this is due to their relatively late arrival, and their emphasis on cattle and pasture development rather than food crops. Their gross income has been low, and their other earnings are not worthy of note. Their financial strength is indicated by their low debt to the Bank, their high liquid assets, and their employment of numerous wage laborers in clearing forest and preparing pasture. Without exception they all plan to develop cattle *fazendas* in the Amazon.

It seems clear that the Northeasterners, Northerners and Central-Westerners are not technologically inferior to the Southerners. If anything, they have shown some signs of superior performance. In showing that the Northern and Northeastern populations are not impeding the agricultural production of the Transamazon we do not wish to infer that the Southerners are doing so. As Table 20 points out, Southerners have averaged over 30 hectares cleared in three years, a feat well worth mentioning. Only the Northerners come close to this rate with 22 hectares cleared in the same period. Income from production of the three major crops is highest among Southerners, but this cannot obscure the fact that the Southerners have lower yields per hectare than their Northern neighbors (i.e., Cr$687.22 vis-à-vis Cr$807.62 for the Northerners).

What the Northerners lack in gross income from major crops they made up in earnings from wages and other farm activities. See Table 21 for income figures. Gross income for Northerners was Cr$13,600.00 per household in 1973-74. On the other hand, Southerners earned only Cr$11,691.00, despite higher bank loans, more cattle (See Table 22), and more liquid assets. Northeasterners had the lowest gross income per household (Cr$7,331.00), followed closely by the Central-West farmers (Cr$7,349.00). Lest we conclude that Northerners are "the best farmers," it is important to weigh all the above assets and liabilities of all the regional groups involved.

For instance, a further indication of agricultural success would be the production of cattle. While this is not strictly a "farming" pursuit, it nevertheless can be used in illustrating the variety of managerial skills among the colonists. Secondly, the colonists themselves view cattle ranching as preferable or more prestigious than farming. All aspire someday to own cattle.

From the sample of 101 families it has been shown that most of cattle in the Transamazon are owned by Northeasterners (See Table 22). In addition, the Northeastern owners have more cattle per capita than owners from the other regional groups (38.5 apiece). There is however, a great maldistribution of cattle among the Northeastern group, as only 7 percent of the Northeastern colonists are cattle owners. All these owners have had previous experience with cattle raising in their region of origin, either as cowboys (vaqueiros) or former cattle ranchers (fazendeiros).

TABLE 21

INCOME FROM FARM AND NON-FARM SOURCES

Average	North	Northeast	Central-West	South	Mean Average
Income from production* per farm in Cr$ 1971-1972	2,841	3,226	800	5,673	2,410
Income from production per farm in Cr$ 1972-1973	3,048	3,462	1,333	4,755	3,150
Income from production per farm in Cr$ 1973-1974	5,088	3,464	2,570	6,185	3,749
Income from wages per household in Cr$ 1972-1973**	3,695	2,456	3,800	1,759	
Income from wages per household in Cr$ 1973-1974	5,143	2,394	2,654	3,229	
Other farm income per household in Cr$ 1973-1974***	3,370	1,493	2,126	2,277	
Liquid assets per farm	4,081	6,444	9,310	6,629	

*"Production" again refers to rice, corn and beans only.

** Wage averages are not given for 1971-1972 because very few farmers in the sample worked for wages during that period.

***"Other farm income" refers to income derived from the sale of manioc flour, root crops, tobacco, eggs, milk and meat. Figures are only given for 1973-1974 because few farmers had had time to develop such income sources before this period.

TABLE 22

CATTLE OWNERSHIP BY REGION

	North Region	Northeast Region	Central-West Region	Southern Region	Total
Number of cattle	16	77	41	65	199
Percentage of total cattle	8%	39%	21%	33%	100%
Average number of cattle per owner	3.2	38.5	20.5	8.1	
Percentage of region who are cattle owners	14%	7%	18%	33%	
Percentage who are non-owners	86%	93%	82%	67%	

The widest distribution of cattle ownership is found among the Southerners, who control one-third of the cattle in the area. These small herds are maintained principally by gaúchos who have come from the European tradition of mixed farming. While some of the herd are utilized for meat, the gaúchos make a greater use of a broad range of dairy products produced by the cattle. The Central-West farmers, although new to the area, already rank second in the number of cattle per owner. As was mentioned previously, the Central-West colonists intend to re-establish cattle fazendas in this new area. The Northerners, on the other hand, represent the second lowest number of owners per region, and the least number of cattle per owner. This is to be expected. Unlike the Southern gauchos, the Norheastern vaqueiros, and the Central-Western fazendeiros, the caboclo farmer has not had much of a cattle raising tradition.[2]

What emerges from this discussion is that the evidence does not point to any cultural advantage on the part of Southerners in all areas of farm management. They are not completely useful as a "demonstration effect" to the rest of the farmers. Their yields per hectare are low, they incur heavy debts, they do not compare favorably in the use of the available technology, and have lower gross income than, for example, persons from the North Region. Nor does the evidence show the Northeasterner as an inferior farmer. What is perhaps most evident and characteristic of Northeastern farmers is the wide disparities among them. Some are excellent independent farmers and entrepreneurs, while others come close to living up to popular stereotypes. For instance, the disparities are noted in terms of the ownership of powersaws. One in five persons from the Northeast has one, and it is the use of this tool which supplies much of the wages earned by the Northeasterners. In all, there is no justifiable evidence to accept "region of origin" stereotypes as a factor in predicting the bottlenecks to agricultural development in the Amazon Region.

Often associated with the regional stereotypes are generalizations about the educational level of rural populations from these different areas. The Northerner and Northeasterner are pictures as "illiterates" and, by extension, the Southern and Central-West inhabitants are said to have had more access to education and have made good use of this opportunity.

TABLE 23

EDUCATION LEVELS BY REGIONS

Percentage	Illiterate	Read and Write	Incomplete Primary	Complete Primary	No Data Available	Total
From North	33%	2%	44%	11%	10%	100%
From Northeast	27%	13%	43%	10%	7%	100%
From Central-West	18%	9%	55%	18%	-	100%
From South	28%	12%	57%	3%	-	100%

Table 24 shows that while Northerners (41 percent) and Northeasterners (28 percent) do account for a major portion of the illiterate population in the Transamazon, the same groups also account for the greatest portion of the most fully educated. Forty percent of those farmers who completed primary school were from the North and, 30 percent were from the Northeast. This again points to the widespread differences among persons within these two regional groups. The other two groups are less dramatic and have a more even distribution of persons in the various educational categories. While it may be true that educational facilities have been less available in the North and the Northeast, those who could take advantage of such an opportunity were more likely to complete their schooling than those from the South and Central-West Regions.

TABLE 24

INTER-REGIONAL EDUCATIONAL LEVELS

	Illiterate	Read and Write	Incomplete Primary	Complete Primary
Percentage of each category from North	41%	11%	33%	40%
Percentage of each category from Northeast	28%	44%	27%	30%
Percentage of each category from Central-West	7%	11%	12%	20%
Percentage of each category from South	24%	33%	28%	10%
Total	100%	100%	100%	100%

It is often assumed that education, or lack thereof, acts as a serious constraint or limiting factor to agricultural development (Schultz, 1964:174-184). Nelson (1973:73) has suggested that in the pioneering stages of new land development, education may not be critical to farming success. Education can actually become a deterrent to the hard work required in clearing a jungle area and establishing it in crops. In areas of the world where education is not universal and is not taken for granted, those with a higher education often take on a higher status that culturally inhibits their performing manual tasks. The educational level of Transamazon settlers was generally low, but some have completed primary school. Table 25 relates educational level to income from production, from wages, and other liquid assets for the greater Transamazon sample. Note that while income does not automatically go up with increased education, an educated farmer's income does have a tendency to go up over time--as the region moves from a "pioneering stage" to a "consolidation stage" (Nelson, 1973:73). However, it should be noted that the illiterate group is able to provide a more stable source of income to their families than those in the other groups. Those with more education do relatively better in earning wages to supplement farm income. They also improve quickly over time. For 1973-74, their gross income was over Cr$17,000, which strongly contrasts with the Cr$10,655 of those with incomplete primary school; Cr$6,335 earned by those who could read and write; and Cr$8,968 for illiterate farmers. Note too, that even after three years, literacy in itself is no guarantee of better living standards. A number of the illiterate colonists have managed to hold foremen jobs that give them valuable experience, without the prerequisite of schooling. It is argued here that in the early stages of colonization, education (or lack thereof) should not be a requirement for "selection." However, from the evidence presented in Table 25, it does seem that education becomes incresingly important over time. It is suggested, then, that formal and informal education be provided for from the earliest possible period as both an essential and a solid investment on the part of the government.

How long a man has worked in the agricultural sector was also considered by planners to be an important factor in chosing potentially successful settlers. The evidence presented in Table 26 fails to support this as a relevant factor. While colonists with no agricultural experience

TABLE 25

EDUCATIONAL LEVEL IN RELATION TO INCOME AND LIQUID ASSETS

Average	Illiterate	Functional Literacy	Incomplete Primary	Complete Primary	Total Average
Income from production 1971-1972*	3,622	4,235	4,734	970	3,390
Income from production 1972-1973	4,531	2,572	3,301	4,210	3,654
Income from production 1973-1974	4,008	2,035	4,542	10,900	5,372
Wages earned per household 1972-1973	993	6,000	3,400	4,111	3,626
Wages earned per household 1973-1974	2,254	3,352	3,789	4,595	3,497
Other farm income earned per household 1973-1974	2,711	955	2,324	2,821	2,203
Liquid assets per household**	6,122	10,406	3,884	6,750	6,790

*As in previous cases this is crop production for rice, corn and beans only. Other sources of farm income are listed under "Other farm income" in the above table.

**The value of cattle is included in these figures.

TABLE 26

THE RELATION OF PREVIOUS AGRICULTURAL EXPERIENCE TO AGRICULTURAL PERFORMANCE IN THE TRANSAMAZON

Average	None	1-5 yrs.	6-10 yrs.	11-15 yrs.	16-20 yrs.	21 plus yrs.	Mean Average
Income from production 1971-1972	2220.	1448.	4478.	5534.	4669.	2700.	2841.
Income from production 1972-1973	800.	3097.	1910.	3039.	3618.	5044.	2918.
Income from production 1973-1974	4855.	8225.	3364.	3314.	6448.	4438.	5107.
Income from production of other crops 1973-1974	3539.	5240.	938.	1883.	5867.	1399.	3144.
Income from wages 1972-1973	3150.	1626.	250.	1500.	2493.	4760.	2297.
Income from wages 1973-1974	3350.	912.	3041.	1192.	3002.	6072.	2830.
Liquid assets per household	3817.	1573.	2032.	5372.	6346.	8668.	4634.
Gross income per farm 1973-1974	11,744	13,787.	7344.	6388.	15,316.	11,907.	--

whatsoever performed below the norm in the first two seasons, by the third year they had a crop production that compared favorably with that of farmers who had six to fifteen years of previous experience. What the largely urban farmers lacked in agricultural production in the first years, they made up in superior wages. The average income from major crops from 1971 to 1974, illustrates that having only one to five years of experience was no less of a handicap than having six to fifteen, or even over twenty-one years of previous farm experience. If we make a brief graph of the gross income for 1973-74, it can be seen that there is little basis for claiming that urban persons, or those with less agricultural experience, are less likely to adapt to agricultural work requirements or be less productive than more experienced colonists (See Figure 17). In a number of ways, persons with largely urban experiences provide several skills that otherwise would be lacking in a frontier area. Part of the reason for the relatively high gross income of persons with zero to five years of farming experience is that, while they seek wage labor they pay other workers to till their fields. This, in effect, gives them time to learn about farming and eases their adaptation to the hard work of tilling the land. Some individuals with far more farming experience are not doing as well because they insist on doing things according to customs which are not always adapted to the requirements of the Amazon Region.

Brazilian planners had assumed that the factors discussed in this section were significant criteria for selecting successful farmers. The ineffectiveness of these criteria, however, should come as no surprise. They were the same criteria that have been used in directed colonization elsewhere with equally disappointing results (Nelson, 1973: 196; Dozier,

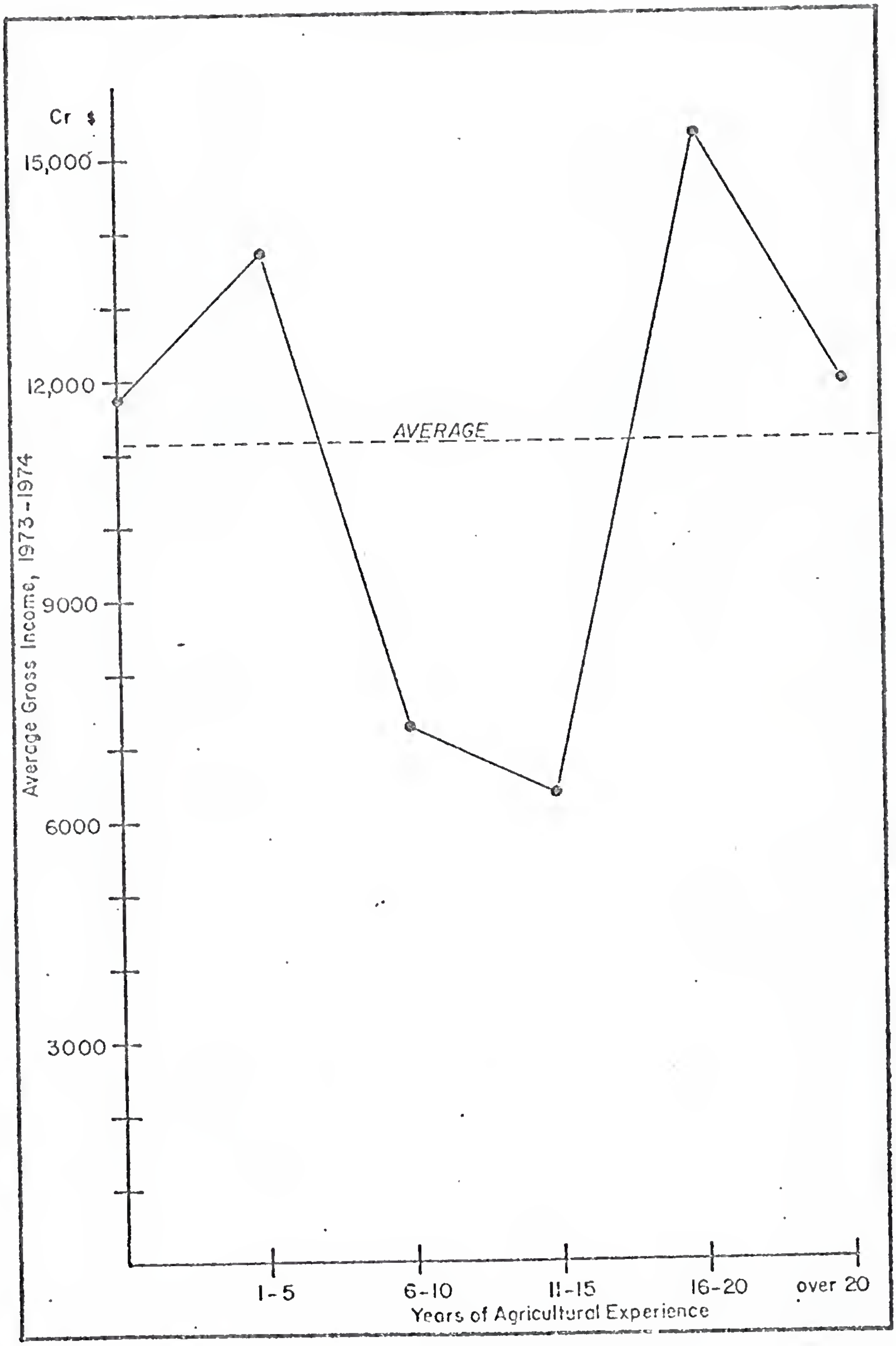


Figure 17. Relationship of Previous Agricultural Experience to Gross Income (1973-74)

1969:200). Nelson's study of 24 different colonization programs indicates that not only were the selection criteria similar in these projects, but so were their most crucial problems. There is almost universal agreement that the problems of deficient transportation, ill health, poor soils, and a lack of sufficient credit have been more serious deterrents than the actual performance of the farmers. As will be discussed in the following section, the Transamazon project is encountering some of these very problems, even though extensive plans were made to avoid them. The various government efforts and the reasons for their lack of success will be examined.

Transportation Constraints

An expensive road construction program is often justified in terms of cost-benefit analysis. However, as Nelson (1973:212) points out, "The initiation of growth is fundamentally different and a more difficult task [than the promotion of growth] and usually requires a more careful appraisal of non-economic factors as well [as cost-benefit studies] ." For instance, the cost-benefit analysis of a road usually takes into account such factors as its presumed cost, its expected impact, the increase in net value of the area, the area's expected total production, and the transporation costs per kilometer for using the road. Such factors, however, can be discerned only if the road actually exists.

The Brazilian planners did not attempt an immediate cost-benefit analysis of the highway. Rather, they stated the immediate benefits in more tangible terms, such as national security and national integration (Resende, 1973). Whether the agricultural program was developed simultaneously to justify the economic costs of the highway system is unclear. Nevertheless, the colonization program does lend some explanation for a road which does not yet serve as a functional link between major population centers. Had the government attempted a cost-benefit analysis of such a scheme, before undertaking it, they might very well have been discouraged from the very start (Nelson, 1973:201).

Since the construction budgets had been outlined according to the lowest bid, final expenditures for building threw the project accounts out of order.[3] Actual costs were often two or three times the estimated cost (See Table 27). Since it was politically important to accomplish the construction in record time, in 1972, 612 kilometers of projected side roads were not built because of budgetary constraints.[4]

This shift in priorities seems a likely solution to an unexpected budgetary problem. The difficulty which arises is that access to the farmers' land was severely hampered. There are numerous cases throughout Latin America where maintenance of project roads is inadequate despite high public investment. With the lush plant growth and heavy rains of the humid tropics, a feeder road will be impassable in one or two years if it is neglected (Nelson, 1973:204). Most farm lots in the Altamira Project are not along the main highway,[5] but may be situated as far back as 20 kilometers from it. Since the colonists expected these side roads to be constructed, many planted sizable crop areas with the expectation of a large marketable surplus. When harvest time came and no access road had been built, much of this production was left stacked in the fields, and was destroyed by pests and rotted by humidity.[6]

Farming decisions which were based on the assumption of a passable road eventually led to the inability of many farmers to pay back their bank loans, and as a result they lost their bank credit in the following years. It seems unjust to criticize the poor technology and productive capacity of the Transamazon pioneers under these circumstances. By 1974, the national and international news media criticized the Transamazon Project, expressing disappointment at its low agricultural yields. While

TABLE 27

REAL AND ESTIMATED COSTS OF TRANSAMAZON HIGHWAY BUILDING

Company Awarded Contract	From-To	Kilometers	Days	Estimated (in 1,000 Cruzeiros)	Real (in 1,000 Cruzeiros)
Constructora Mendes Júnior	Estreito-Marabá	280	1,000	38,000	82,000**
S.A. Paulista	Marabá-Jatobal-Rio Repartimento	270	817	43,000	119,859
Constructora Mendes Júnior	Rio Repartimento-Altamira	342	817	43,793	115,487
Consorcio Transcon-Humberto Santana*	Marabá-Rio Repartimento Altamira Lot 3	Consultant	548	2,200	3,982
Queiroz Galvão S.A.	Altamira-54 W 4 S.	256	1,000	38,000	82,000**
Louis Berger Eng. Ltda.	Altamira-54 W 4 S.	Consultant	760	2,200	5,202
Empresa Industrial Técnica, S. A.	54 W. 4 S.-Itaituba	230	1,000	45,861	117,500**
Constructora Rabello S.A.	Itaituba-Jacareacanga	300	565	28,868	171,443
Camargo Correa S.A.	Jacareacanga-Rio Aripuaná	406	504	57,211	140,429
Companhia Constructora Parapanema	Rio Arupuaná-Humaitá	350	566	29,107	74,783
Totals		2,434	7,577	328,240***	912,685***

TABLE 27 Continued

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[*] This company defaulted on its contract and its task was taken up by Mendes Júnior S. A.

[**] In these three cases the added cost is partially explained by the post-contract request for construction of a military post at an average cost of Cr$32,000,000 for each one. Inflation undoubtedly added to the cost.

[***] Estimated cost per kilometer was Cr$134,856. Real costs were actually Cr$375,970 (US$53,710) per kilometer.

Source: Contracts Office; Departamento Nacional de Estradas de Rodagem, Rio de Janeiro, 1974.

some critics mentioned the lack of road and transportation difficulties, the connection between poor transportation and farmer productivity was rarely made. As of 1974, the road system served only a minority of the region's producers. The lack of passable side roads affects not only the transportation of agricultural goods, but also the extension services, the development of agrovilas on side roads, and the provision of health care. In short, the general well-being of farmers is dependent on this most basic facility. If both national and economic goals are to be met, construction and maintenance of side roads should be accorded comparable importance to that of the main highway.

Health Constraints

To the settlers the most serious potential constraint to farming is poor health. They have reason to worry. The Amazon is replete with tales of debilitating diseases. Malaria has always loomed as a major drain on the strength of tropical peoples (Gourou, 1966:8). Serious efforts during World War II controlled its spread but failed to totally eradicate it. Yellow fever, while enzootic in the wildlife of the Amazon region and impossible to eradicate, is well under control among the human population (Causey and Causey, 1974:270). Innoculation of colonists on, or before, arrival to the Transamazon was an added precaution taken by the colonization authorities. Transmissible diseases in the Amazon, however, are notably infrequent when compared to the incidence of such diseases in more heavily populated regions. With the building of highways, one can expect that these and other health problems will become more serious. We will argue that while not necessarily a constraint to Amazonian agricultural development, health is nevertheless an important factor which can seriously affect agricultural output.

By far, malaria, gastro-intestinal disorders, and accidental injury (trauma) account for most hospital admittances (See Table 28). These three problems also account for the majority of deaths and the longest periods of hospitalization (See Table 29).[7]

Notice that while malaria is the most frequent problem, it is not the greatest killer. Gastro-intestinal disorders are far more serious in this respect. This health problem, however, has its highest fatality among children between infancy and four or five years of age. This occurs because the accompanying dehydration usually is severe. The problems of malaria and trauma are more significant in terms of agricultural production since they are mainly incurred by males between the ages of 15 and 50. In fact, an age-sex pyramid of the total admitted cases shows a predominance of older males, if we discount women who come to give birth and children who are treated for childhood diseases and the subsequent secondary infections (See Figure 18). This peculiar situation, where men are admitted for more serious health problems reflects their greater exposure to malaria and injury while working in the fields, and their key role as "bread-winners" in the household. It is rare to see a man postpone medical treatment for an incapacitating problem. Women, on the other hand, are more likely to postpone a visit to the doctor and attempt to cure a persistent malady with home-made herbal remedies.

The diseases which most affect the Transamazon population have seasonal fluctuations. Malaria, for instance, shows a double peak, one at the beginning of the rainy season and again at the end. Accidental injury is most frequent during September through November at the time when tree felling is scheduled to take place (See Figure 19).

TABLE 28

ADMISSIONS AT ALTAMIRA HOSPITAL

	1970		1971		1972		1973	
	Cases	% Cases Admitted	Cases	% Cases Admitted	Cases	% Cases Admitted	Cases	% Cases Admitted
Malaria	28	33.7	158	48.6	188	21.4	501	36.7
Trauma	17	20.5	49	15.1	110	12.6	139	10.2
Gastro-intestinal	12	14.4	29	8.9	154	17.5	132	9.7

Source: Data from the SESP Hospital in Altamira. These are only cases which were admitted for treatment. So this is a record of "serious cases," rather than an indication of total incidence. Information is courtesy of Nigel Smith.

TABLE 29

INCIDENCE OF DEATH OF HOSPITAL PATIENTS

	1971			1972			1973		
	Days/ case	Total Deaths	% of Population	Days/ case	Total Deaths	% of Population	Days/ case	Total Deaths	% of Population
Malaria	3.7	4	.07	3.9	2	.02	5.2	17	1.4
Trauma	4.7	1	.02	5.7	4	.04	8.0	3	.02
Gastro-intestinal	4.7	2	.03	4.3	16	1.6	6.0	26	2.2
Total Population		5,741			9,600			11,740	

Source: SESP Hospital in Altamira. Information is courtesy of Nigel Smith.

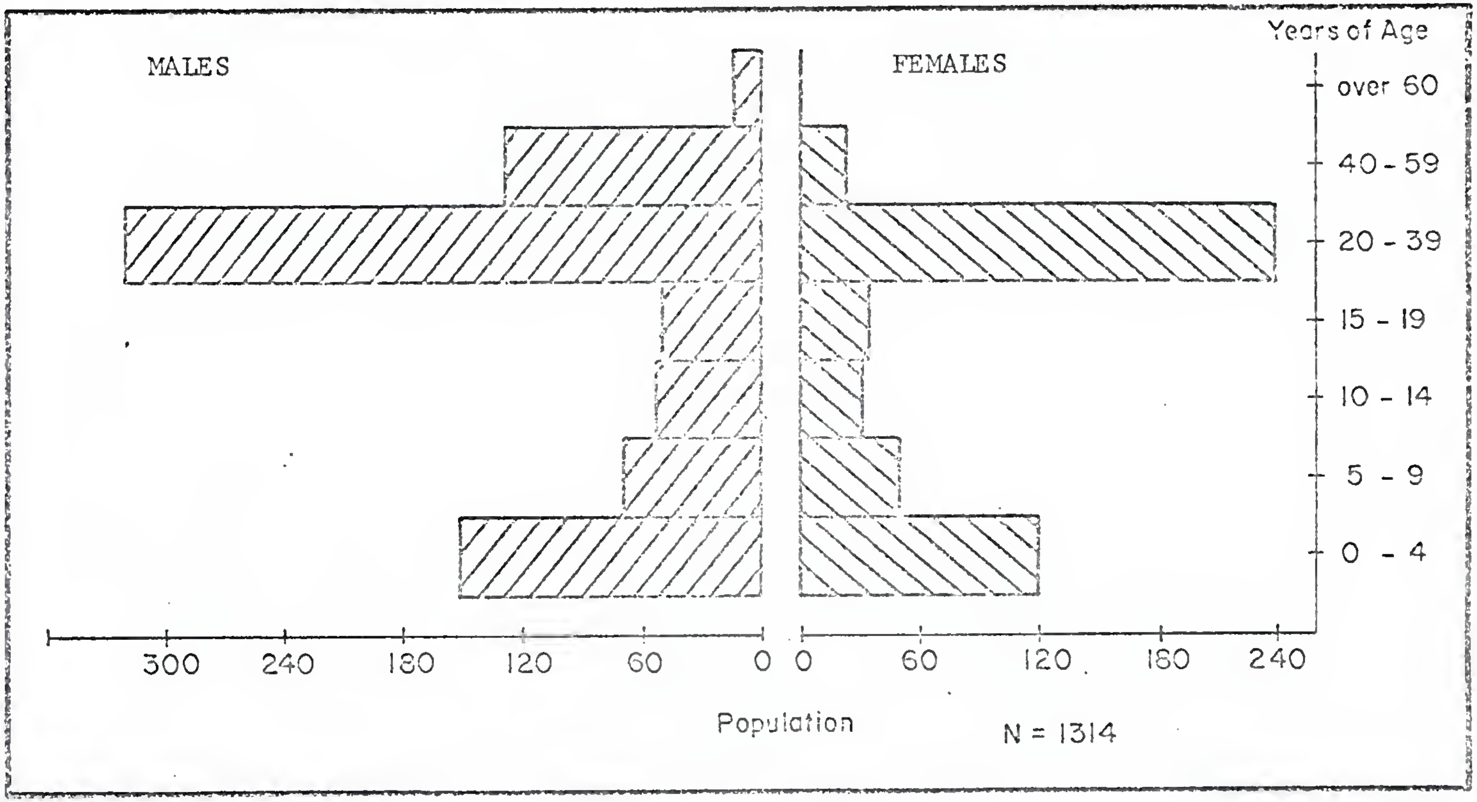


Figure 18. Age-Sex Pyramid of Hospital Admittances in Altamira (1973)

Source: Nigel Smith, Field Notes, 1974.

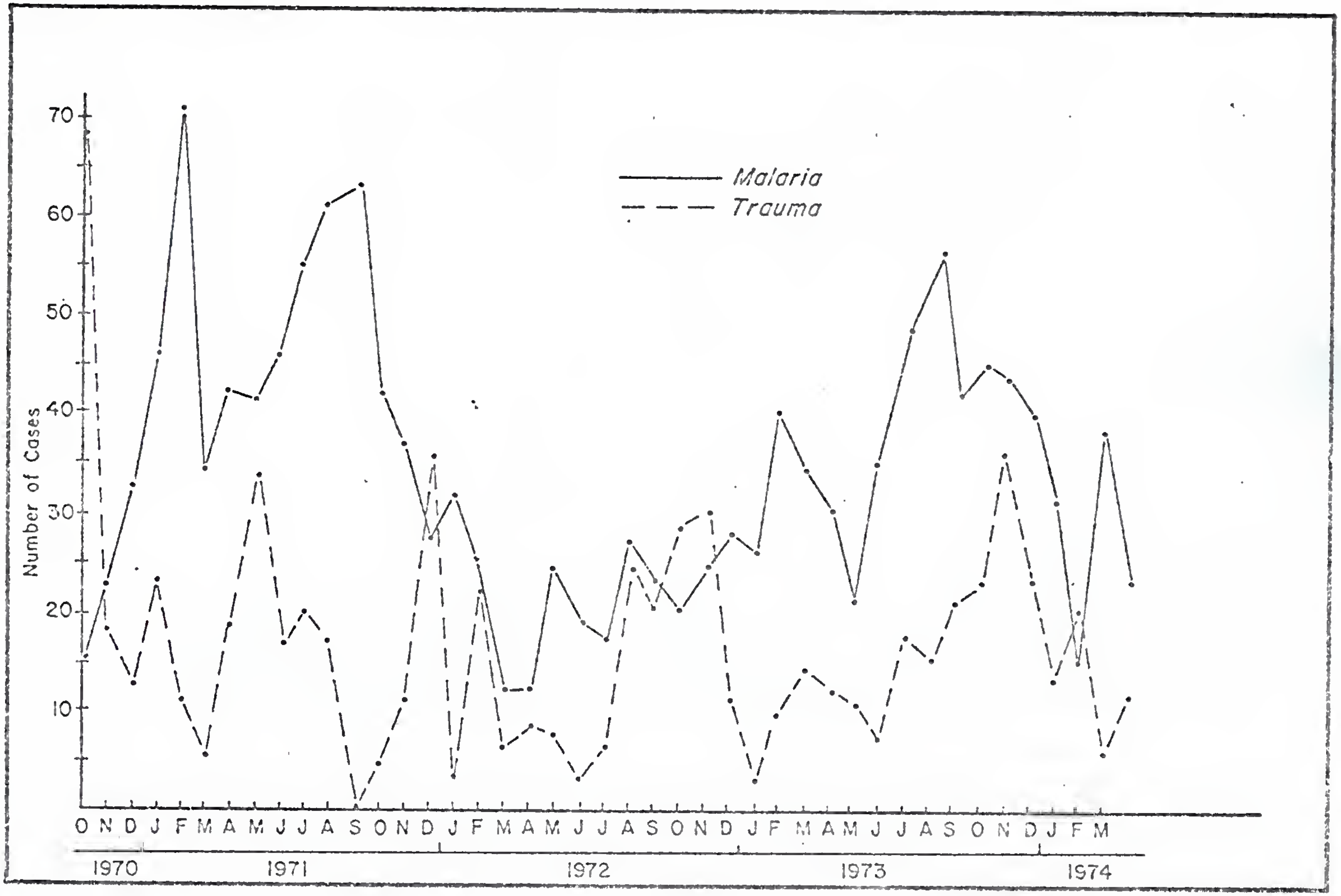


Figure 19. Seasonal Fluctuations in the Incidence of Malaria and Trauma

A health problem that has caused the death of a few small children, and much general distress in the area is the blackfly (Simulidae spp.). These insects are known as piuns in the Amazon. Some species of this insect cause an allergic reaction in many persons that may call for treatment with steroids. An irritating substance which is injected by the insect can often break down the blood platelets and cause a local hemorrhage. Persons bitten over a great portion of the body may need treatment with cortisone to reverse the platelet breakdown. The presence of these insects during the rainy season forces farmers to dress in heavy trousers, long-sleeve shirts, and boots. The pant legs and shirt sleeves must be closed with rope so that these tiny insects cannot get inside. In a hot and muggy region such as the Amazon this clothing causes great discomfort in itself, apart from the itching and bleeding bites of the bothersome insects. Scratching the bites may also lead to the development of open wounds which can then develop streptococcal infection. In short, during the rainy season, farmers tend to minimize their stay in the fields and often carry out their chores with more distraction than concentration.

The survey of 101 colonists yielded data on the number of work days lost due to various health problems. Colonists lost an average of 11.5 days per year due to illness or injury. The most frequent of these disturbances was malaria, which on the average would incapacitate a farmer for eight days. In Vila Roxa one in five households had at least one member who suffered from malaria during our year of residence there. In examining the interviews, it was not uncommon to find persons who had lost from 90 to 108 days due to some particular ailment. Nonetheless, settlers were of the general opinion that the Amazon was a healthy area.

There was general agreement by the farmers that the three most detrimental problems in the area of health were malaria, the blackflies, and the rats. The black rat (Rattus rattus) is ever present in the houses of Transamazon farmers who are in the habit of storing their grain production in the home. No serious diseases seem to have been caused by the rodents' presence nor their occasional bites. The most serious threat to date is the destruction of agricultural produce. But the presence of this ancient disease-spreader presents a constant possibility of a serious health problem.

Credit Constraints

One of the positive features of Transamazon planned colonization is its provision for rural credit. The Federal government enlisted the cooperation of the Bank of Brazil and ACAR-PA in making short-term loans available to pioneer farmers at the subsidized annual interest rate of 7 percent.

The obtaining of credit in itself is a time-consuming process that can become a serious constraint on a farmer's agricultural work. In May or June, colonists make a loan request by indicating the acreage they plan to clear and plant in the three major food crops or in such permanent crops as black pepper, guaraná, cacao, and others. Making out the initial credit plan is a relatively simple step and usually entails only one to three trips to the planned town of "New Brazil."

Table 30 provides an insight into the number of days lost from farm work in seeking credit, and its equivalent cost if a farmer were paying a wage laborer to take over in his absence. After credit is approved, it is the responsibility of the extension agency to approve

TABLE 30

COSTS INVOLVED IN THE SECURING OF CREDIT

	Man-days	Cost (in Cr$)
Making plan	1 to 3	15 to 45
Confirmation of approval	3 to 5	45 to 75
Reception of six payments	12 to 20	180 to 300
Transportation costs	--	340 to 600
Pay interest on loan	1 to 2	15 to 30
Total	17 to 30	595 to 1050

each of the six payments (parcelas) which are to be doled out with the completion of each step of land preparation. For instance, the agent is supposed to inspect the underclearing before money is released for tree felling and so on. Rarely does the extensionist visit farmers. Nevertheless, the requirements that the farmer seek a "release of credit funds" from the extensionist remain. Accordingly, the farmer must find the extension agent of his area and obtain the authorization for each parcela. This could take anywhere from one, to as many as four or five trips.

Once the authorization is obtained, then the farmer has to pay transportation to Altamira and seek release of the funds by the Bank. The Bank functions only between eight a.m. and noon, Monday through Friday. If the transaction with the extension agent can be completed before 10 a.m. the farmer has a small chance of getting to Altamira before the bank closes. With the system of transportation as it is, this was very unlikely. Under the best conditions, a farmer loses two work days and pays at least Cr$40 in transportation for each parcela. If one adds the cost of the farmers' labor per day, each parcela costs a farmer a minimum of Cr$70. Frequently, this figure may be two or three times higher.

After the harvest, the farmer must go into town once again to pay the interest on the normal three-year loans. One-year loans on the other hand, are simply discounted from whatever of the annual production is sold to COBAL-CIBRAZEM. Sometimes the annual loans are paid in cash after selling all of the produce to a private dealer. While the time lost for this process differred from farmer to farmer, there were no cases where less than 17 man-days (equivalent to Cr$255) and Cr$340 for transportation were expended.

The minimum cost of obtaining a loan is Cr$595. Adding the charge of 7 percent interest, say Cr$168, on the most commonly requested loan of Cr$2400, the total cost of a loan rises to Cr$763. This is a minimal figure since, previously indicated, a farmer may need to make a great number of trips to obtain his payments. In addition, the time lost in the obtainment of credit falls exactly in the periods of most intensive agricultural labor. Between the costs of interest rates, transportation, and work-days lost, a farmer may spend from one-third to one-half of his loan simply in obtaining his credit. This is likened to his paying not 7 percent but 33 to 50 percent interest on his bank loan, and in the end having only one half of his loan available for farm purposes. It is no wonder, that farmers have had little to show for the amount of credit they have received from the bank.

Credit can be a serious constraint to agricultural production even when it is available. More time is lost in seeking credit than in illness.

If a farmer knows he has access to credit, he is likely to clear a larger area than he might otherwise. He may invest a large proportion of savings into underclearing in the expectation of getting his money back when the first installment of the loan comes in. However, if the bank money is released too late, the appointed time for tree felling may have arrived without any sign of incoming funds. The farmer may again dip into his own savings or borrow locally, but may not have enough money to completely clear the total area he started. In some cases the farmer may let part of the large undercleared area go to secondary growth. If so, he has lost his scarce savings and will have to pay back the loan from the limited area which was cleared and planted. If the fields produce but the harvesting funds are late he may even lose a sizable portion of his production in the fields due to insufficient funds to pay harvesters. In either case, the poor timing of credit release is more of an obstacle than a help.

This is not to say that agricultural credit should not be provided. Rather, if credit is to lead to greater agricultural production, changes are necessary. The most obvious improvement would be to make the loan available in one lump sum, rather than in six payments. This would reduce much of the expense of transportation and lost work days. Secondly, this should be combined with an effective visitation program by extension agents. The first credit parcel should be timed for late June so that underclearing can begin on schedule. Consequently, credit plans should be drawn earlier, perhaps in April or May. Such minor changes would effectively double the amount of actual credit given to the farmer. Comparable increases in production should then result.

Soil Constraints[8]

Besides the constraints presented by poor health, possession of productive or unproductive soils also seems to be an important factor in agricultural output. Tropical soils are generally said to be highly weathered and leached, having high acidity and low nutrient levels except in a few inches of topsoil (National Academy of Sciences, 1972:1-2). On the other hand, many such soils, including those in the Transamazon, tend to be well-drained and well-structured.

A general survey of Transamazon soils now exists (Falesi, 1972; IPEAN, 1974), but its results were not readily available when the majority of farmers arrived in the area. Faced with the lush and unfamiliar vegetation, farmers chose their land according to criteria that had little to do with Amazon soil-plant relations. In Chapter IV a comparison was made between the soils chosen by local inhabitants and newcomers. The Amazonian caboclo chose soils according to the vegetation and his insight was uncanny. Figure 20 (a. and b.) illustrates the higher fertility of caboclo farm lots in comparison to the lots of other colonists. In practically every case the level of organic matter in caboclo soils was above average, the pH close to neutral, the levels of exchangeable bases relatively high, and the amount of exchangeable aluminum was low. These illustrations show the overall fertility of tropical soils by the size of the hexagonal area (See key to Figure 20 for the axis values).

The fertility of the soils in the area of study was much improved by burning (See Figure 20 c. and d.). With burning there is a marked increase in soil pH towards a less acidic condition (See Figure 21). This

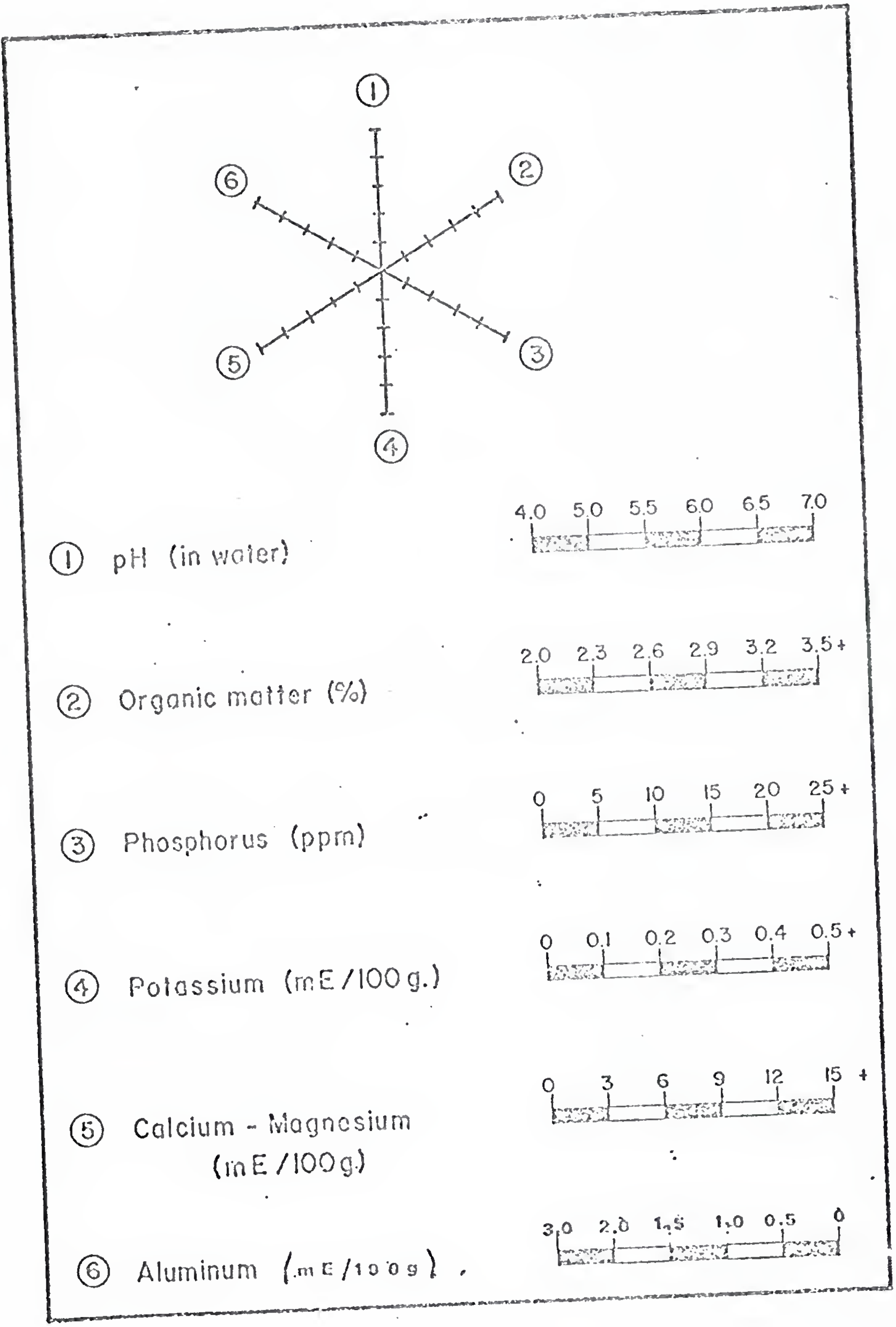
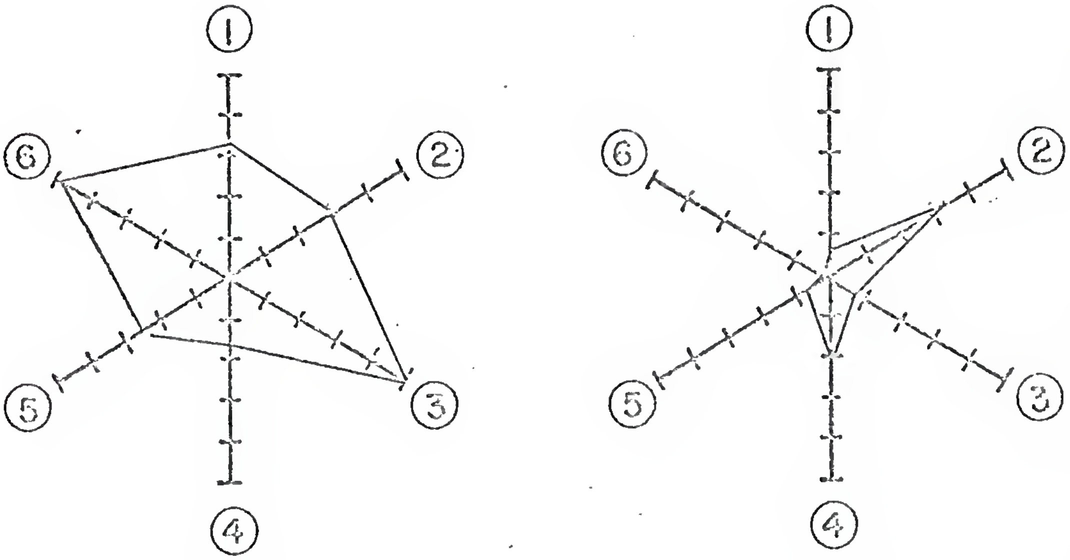
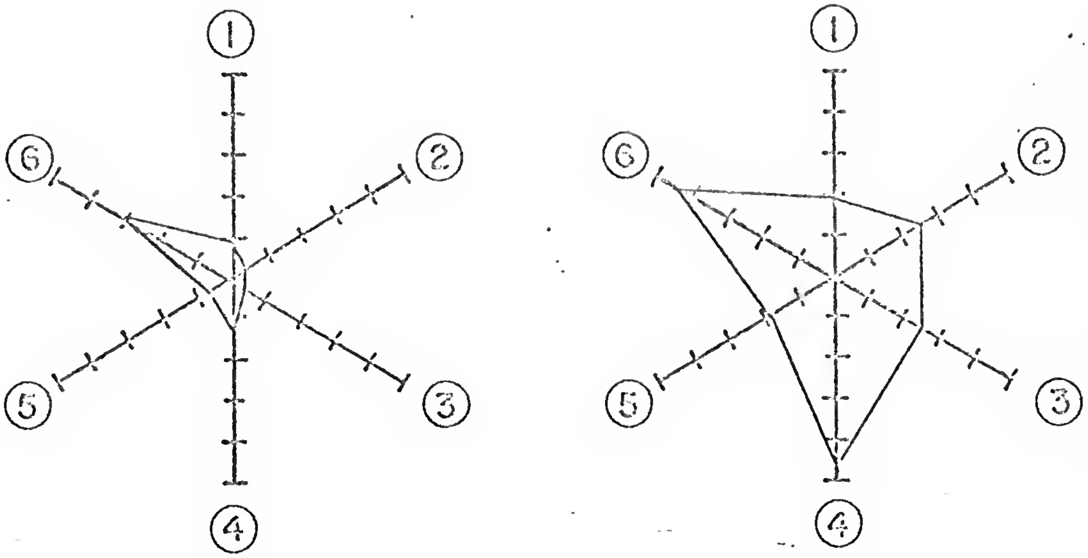


Figure 20. Key to Fertility Diagrams.



a. Caboclos

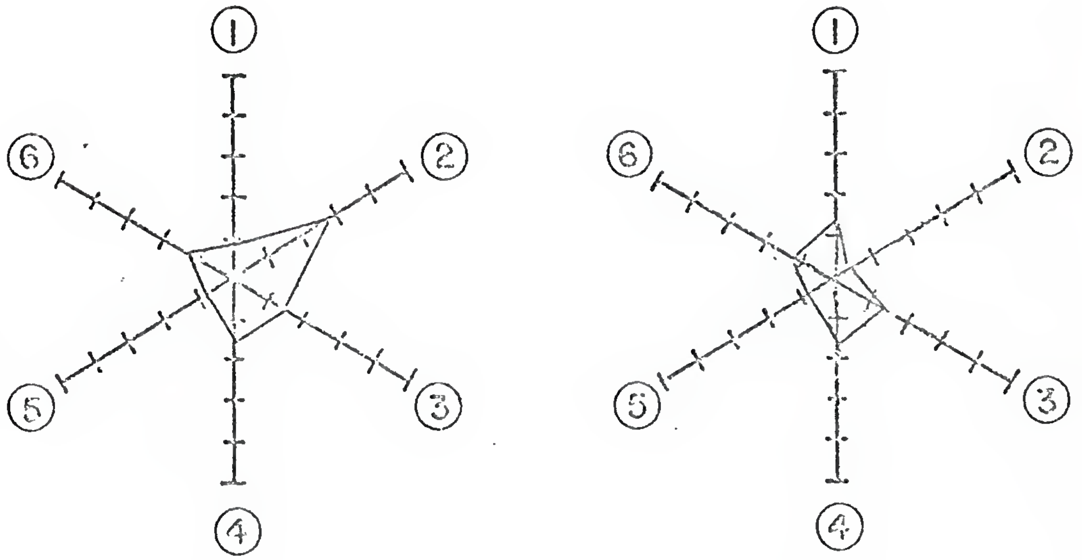
b. Large trees



c. Forest

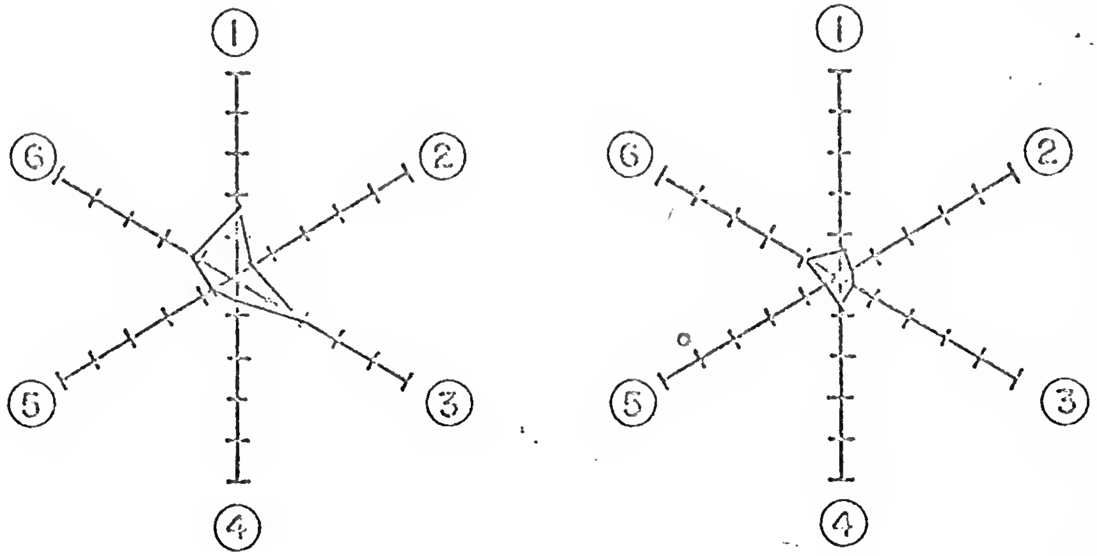
d. Burned fields

Figure 20. Fertility Diagrams



e. First year fields

f. Second year fields



g. Third year fields

h. Second growth

Figure 20. Fertility Diagrams

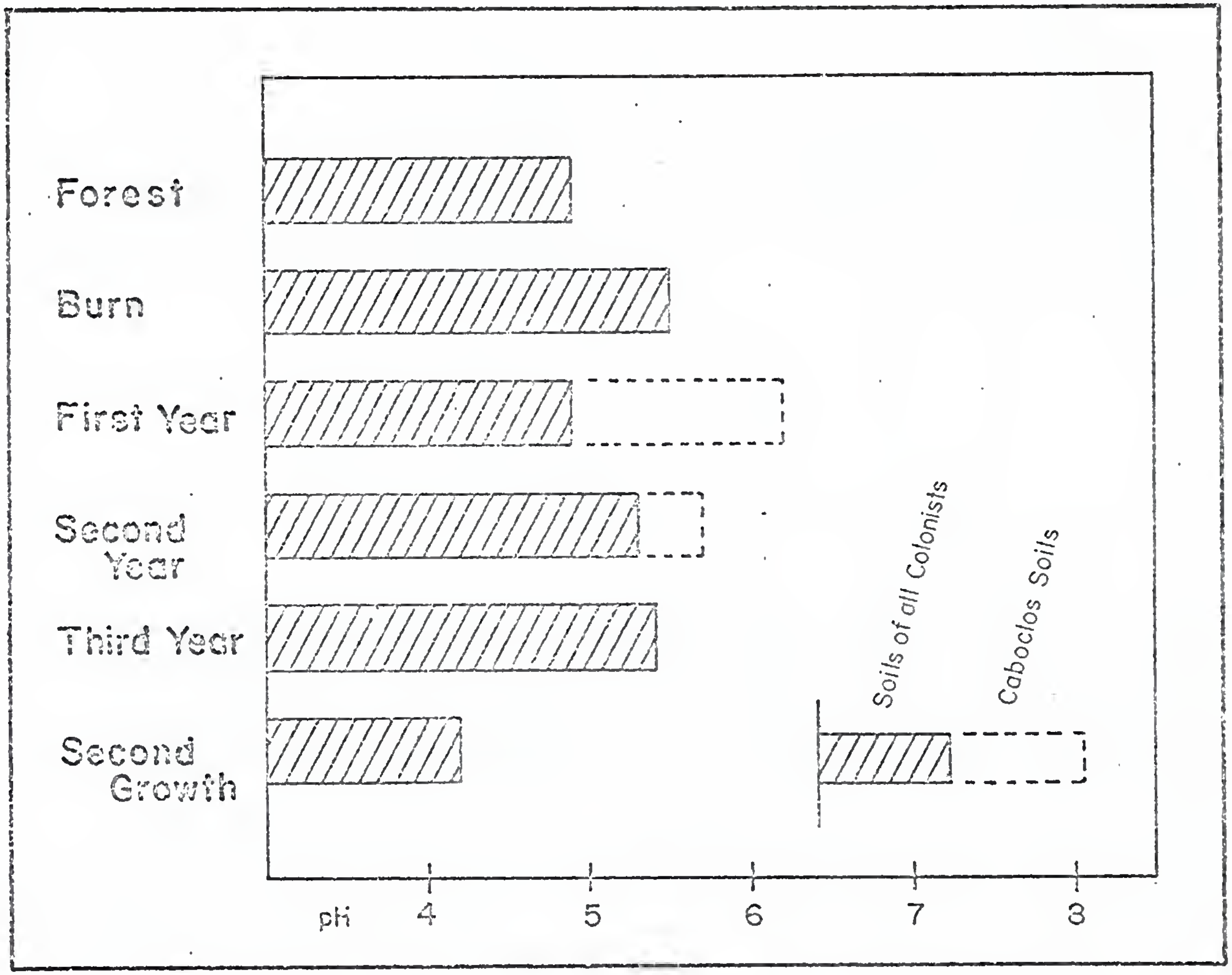


Figure 21. Changes in pH in Various Stages of Utilization

also means that effective cation-exchange capacity is increased (Buckman and Brady, 1969:96). This effectively increases the availability of nutrients and is compounded by a significant increase in the total amounts of phosphorus, potassium, calcium, magnesium and carbon. Nitrogen, however, is not significantly affected nor is there a dramatic increase in organic matter, in comparison to the changes in the other soil constituents. The increase in soil pH is closely related to a reduction in exchangeable aluminum (See Figure 22). This lowers the ever-present likelihood of aluminum toxicity in tropical soils (Popenoe, 1960:100).

With cropping and the leaching action of rainfall and sun, soil pH slowly begins to return to a more acid state, and carbon and organic matter levels gradually drop. Usually, however, more than three years are required for a complete return to natural levels. There is also a very slight decrease in nitrogen. Calcium, magnesium and potassium increase after burning but they, too, over time, return to levels found in climax forest. Potassium levels gained by burning hold up well after two cropping seasons (See Tables 31 to 37). The declining fertility which follows burning is illustrated in the hexagonal drawings in Figure 20 c. to h.

Very little erosion was noted in the farms despite the rolling terrain. This is probably due to the excellent structure of the soils themselves. Even after torrential storms, it was but a short period before the water had percolated through and was carried off by the complex system of streams. The relatively little weeding done by farmers also helped break the impact of the rain and sun. The minor changes shown in the soils utilized by caboclo are indicative of the high initial

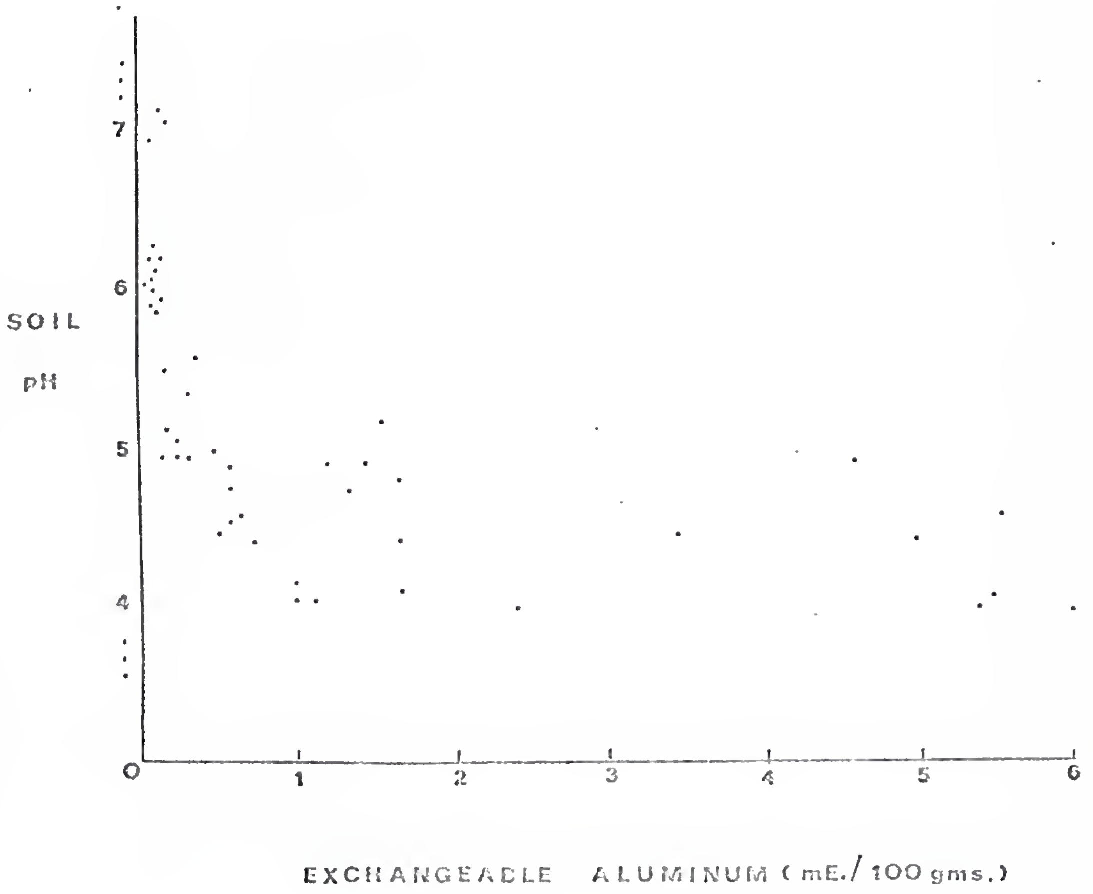


Figure 22. Relationship Between Soil pH and Exchangeable Aluminum

TABLE 31

SOILS UNDER FOREST

	pH^a	P^b (ppm)	K^c	Ca+Mg^d	Sum of ex-changeable Bases	Exchange-able^e Aluminum	Effective C E C	C^f (%)	N^g (%)	O.M.^{h} (%)	C/N Ratio	Soil Color^i (Wet)
			(In Milliequivalents per 100 grams)									
	4.9	1	0.08	0.05	0.58	0.4	0.98	0.53	0.05	0.91	11	10 YR 4/4
	5.7	1	0.35	5.4	5.75	Traces	5.75	1.58	0.16	2.71	10	5 YR 3/4.5
	4.1	4	0.04	0.1	0.14	1.0	1.14	0.68	0.06	1.17	11	10 YR 4/4
	5.8	1	0.18	7.2	7.38	Traces	7.38	1.29	0.23	2.23	6	10 R 2/3
	4.0	1	0.09	0.3	0.39	2.5	2.89	1.11	0.12	1.90	9	10 YR 4/4.5
Average	4.9	1.6	0.15	2.7	2.85	0.78	3.68	1.04	0.12	1.78	9-2	
Range	4.1- 5.8	1-4	0.04- 0.35	0.03- 7.2	0.14- 5.75	Traces- 2.5	0.98- 7.38	0.53- 1.58	0.05- 0.23	0.91- 2.71	6-11	

[a] Determined potentiometrically in water using a glass electrode.

[b] Extracted by use of 0.025 N H_2SO_4 solution and determined colorimetrically in acid solution of Ammonium molybdate.

TABLE 31 Continued

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[c] Extracted by use of 0.025 N H_2SO_4 solution and determined with a flame photometer.

[d] Extracted by using a 1.00 N solution of KCl and determined with 0.025 N of EDTA.

[e] Extracted using a 1.00 N solution of KCl and determined with 0.025 N of N_2OH.

[f] Determined by use of 0.4 N solution of Potassium dichromate.

[g] Determined by use of Kjaldahl digestion flask and 0.02 N HCl solution.

[h] Calculated according to the formula O.M. % = % C x 1.72 (where 1.72 is k factor used to convert C to O.M.).

[i] Determined by use of color chips in M. Oyama and H. Takehara, *Revised Standard Soil Color Charts*, 1967.

TABLE 32

SOILS IN NEWLY-BURNED FIELDS

(In milliequivalents per 100 g.)

	pH	P (ppm)	K	Ca+Mg	Sum of exchangeable bases	Exchangeable Aluminum	Effective C E C	C (%)	N (%)	O.M (%)	C/N Ratio	Soil Color (Wet)
	7.2	32	.79	7.9	8.69	Traces	8.69	1.58	0.22	2.71	7	10 R 3/6
	5.2	6	.55	6.5	7.05	0.1	7.15	1.36	0.19	2.34	7	5 YR 4/4
	5.0	5	.33	3.7	4.03	0.2	4.23	1.63	0.19	2.80	9	5 YR 6/6
	4.7	5	.11	1.9	2.01	0.9	2.91	1.96	0.19	3.37	10	7.5 YR 4/3.5
Average	5.5	12	.44	5.0	5.44	0.3	5.44	1.63	.20	2.80	8	
Range	4.7- 7.2	5- 32	.11- .79	1.9- 7.9	2.01- 8.69	Traces- 0.9	2.91- 8.69	1.36- 1.96	.19- .22	2.34- 3.37	7-- 10	

TABLE 33

FIRST-YEAR CABOCLO SOILS

	pH	P (ppm)	K	Ca+Mg	Sum of ex-changeable bases	Exchange-able Aluminum	Effective C E C	C (%)	N (%)	O.M (%)	C/N Ratio	Soil Color (Wet)
				(In milliequivalents per 100 grams)								
	6.0	48	.18	8.9	9.08	Traces	9.08	2.31	0.22	3.97	11	10 YR 4/2.5
	5.6	3	.12	7.6	7.72	Traces	7.72	1.78	0.22	3.06	8	10 YR 3/2.5
	7.1	26	.09	4.8	4.89	Traces	4.89	1.02	0.10	1.76	10	10 YR 2/2
Average	6.2	25.7	.13	7.1	7.23	Traces	7.23	1.70	.18	2.93	10	
Range	5.6-7.1	3-48	.09-.18	4.8-8.9	4.89-9.08		4.89-9.08	1.02-2.31	.10-.22	1.76-3.97	8-11	

TABLE 34

SOILS IN FIRST YEAR OF CULTIVATION

	pH	P (ppm)	K	Ca+Mg	Sum of Exchangeable bases	Exchangeable Aluminum	Effective C E C	C (%)	N (%)	O.M. (%)	C/N Ratio	Soil Color (Wet)
			(In milliequivalents per 100 grams)									
	4.1	2	.20	1.3	1.50	5.9	7.4	1.83	0.26	3.15	7	7.5 YR 4/3.5
	5.6	35	.24	4.5	4.74	0.2	4.94	1.33	0.17	2.29	8	5 YR 3/3.5
	4.3	4	.16	0.5	0.66	5.0	5.66	3.20	0.24	5.51	13	7.5 YR 3/3
	4.5	3	.04	0.6	0.64	0.7	0.8	0.85	0.06	1.47	14	10 YR 4/3.5
	4.5	1	.04	0.6	0.64	1.0	1.64	0.81	0.08	1.39	10	10 YR 2/3
	5.8	6	.09	3.6	3.69	Traces	3.69	0.79	0.07	1.36	11	10 YR 4/4.5
	4.7	3	.05	1.2	1.25	0.8	2.05	1.01	0.09	1.74	11	10 YR 4/4.5
	6.2	13	.12	2.9	3.02	Traces	3.02	0.60	0.08	1.03	8	10 YR 3/3
	5.2	1	.09	5.4	5.49	Traces	5.49	1.11	0.16	1.90	7	5 YR 3/4
	4.5	1	.25	1.5	1.75	5.6	7.35	1.78	0.22	3.06	8	7.5 YR 4.5/6
	4.5	5	.22	0.1	0.32	5.6	5.92	5.69	0.38	9.78	15	5 YR 2/1.5
	4.2	1	.05	0.2	0.25	1.0	1.25	0.79	0.06	1.35	13	10 YR 4/4
	4.1	2	.05	0.1	0.15	1.2	1.35	1.14	0.08	1.95	14	10 YR 4/4
	6.2	26	.85	12.4	13.25	Traces	13.25	2.67	0.43	4.60	6	7.5 YR 3/1.5
Average	4.9	7.4	.175	2.5	2.67	1.9	4.56	2.04	.17	2.90	10	
Range	4.1-6.2	1-35	.04-.85	.1-12.4	.25-13.25	Traces-5.9	.8-13.25	.60-5.69	.06-.43	1.03-9.78	6-15	

TABLE 35

SOILS IN SECOND YEAR OF CULTIVATION

	pH	P (ppm)	K	Ca+Mg	Sum of exchangeable bases	Exchangeable Aluminum	Effective C E C	C (%)	N (%)	O.M. (%)	C/N Ratio	Soil Color (Wet)
			(In milliequivalents per 100 grams)									
	5.4	6	.17	1.8	1.97	0.2	2.17	0.58	0.05	1.00	12	7.5 YR 4/6
	4.8	1	.13	1.5	1.63	1.8	3.43	0.99	0.09	1.70	11	10 YR 4/6
	5.0	5	.12	2.4	2.52	0.4	2.92	1.16	0.09	2.00	13	10 YR 3/2.5
	5.2	3	.59	0.7	1.29	1.9	3.19	1.27	0.12	2.19	11	10 YR 3/4
	4.7	1	.04	0.3	0.34	1.4	1.74	0.55	0.05	0.95	11	10 YR 5/4.5
	4.6	2	.19	0.7	0.89	5.6	6.49	3.82	0.22	6.58	17	7.5 YR 2/2.5
	6.9	35	.15	5.5	5.65	Traces	5.65	0.83	0.11	1.42	8	7.5 YR 3/4
	5.0	3	.05	0.9	0.95	Traces	0.95	0.36	0.04	0.62	9	10 YR 4/4.5
	6.3	14	.25	3.3	3.55	Traces	3.55	0.68	0.07	1.17	10	10 YR 3/3.5
	5.2	6	.25	6.1	6.35	Traces	6.35	1.92	0.18	3.29	11	7.5 YR 4/3.5
	4.4	1	.06	0.8	0.86	1.8	2.66	0.74	0.08	1.27	9	10 YR 5/6
	5.9	5	.32	6.4	6.72	Traces	6.72	1.08	0.15	1.85	7	10 YR 4/4.5
Average	5.3	6.8	.19	2.5	2.73	1.8	3.82	1.16	0.10	2.0	11	
Range	4.4- 6.9	1-35	.05- .59	.3- 6.4	.34- 6.72	Traces- 5.6	.95- 6.72	.36- 3.82	.04- .22	.62- 6.58	7-17	

TABLE 36

SOILS IN THIRD YEAR OF CULTIVATION

	pH	P (ppm)	K	Ca+Mg	Sum of Exchangeable bases	Exchangeable Aluminum	Effective C E C	C (%)	N (%)	O.M. (%)	C/N Ratio	Soil Color (Wet)
					(In milliequivalents per 100 grams)							
	4.5	1	.07	0.3	0.37	3.8	4.17	1.75	0.14	3.01	13	7.5 YR 2.5/1
Pasture	6.3	20	.05	3.3	3.35	Traces	3.35	0.57	0.05	0.99	11	10 YR 3/4
Average	5.4	10	.06	1.8	1.86	1.9	3.76	.88	.10	2.00	12	
Range	4.5-6.3	1-20	.05-.07	.3-3.3	.37-3.35	Traces-3.8	3.35-4.17	.57-1.75	.05-.14	.99-3.01	11-13	

TABLE 37

SOILS UNDER SECONDARY GROWTH

	pH	P (ppm)	K	Ca+Mg	Sum of Exchangeable Bases	Exchangeable Aluminum	Effective C E C	C (%)	N (%)	O.M. (%)	C/N Ratio	Soil Color (Wet)
			(In milliequivalents per 100 grams)									
Seven year old field	4.8	1	.05	1.5	1.55	1.7	3.25	1.01	0.13	1.74	8	2.5 YR 3/4
	4.8	1	.13	0.2	0.33	4.6	4.93	0.61	0.07	1.05	9	7.5 YR 5/4
	4.9	1	.11	0.4	0.51	1.3	1.81	0.28	0.03	0.42	9	5 YR 4/6
	5.1	1	.05	0.6	0.65	0.4	1.05	0.47	0.04	0.81	12	7.5 YR 5/4
	4.1	1	.12	0.1	0.22	1.9	2.12	1.14	0.08	1.97	14	7.5 YR 4/4
Average	4.7	1.0	.09	0.6	0.652	1.98	2.99	0.70	0.07	1.20	10	
Range	4.1-5.1		.05-.13	0.1-1.5	0.22-1.55	0.4-4.6	1.05-4.93	.28-1.14	0.03-0.13	0.42-1.97	8-14	

pool of available nutrients, the good structure of the soils, and an agricultural system that provides good soil cover.

The Altamira soils cut by the Transamazon highway are among the best found in the terra firme environment. Nevertheless, they are far inferior to the soils studied by Popenoe (1960) in Central America. Organic matter levels are far lower in forest soils but the levels are more constant than in the Polochic Valley. The average nitrogen content in the Transamazon is 0.20 percent, considerably below the 1.13 percent reported by Popenoe (1960:82-83).

Total exchange capacity does not provide an accurate picture of the actual field situation of acid tropical soils.[9] Coleman et al. (1959) and Popenoe (1960:91) contend that the amount of permanent change, that is, the effective cation exchange capacity, provides a more realistic basis for assessing the fertility status of soils in the tropics. In the Transamazon forest soils have a mean average effective cation exchange capacity of 3.68, which is increased to 5.44 with burning. During cropping it declines very slowly to 1.7 after three years of continuous agricultural usage. Abandoned fields covered with secondary growth go still lower, but full recovery to forest nutrient levels take place in slightly over seven years as is evident from the first sample of Table 37. Figure 23 illustrates the changes in effective exchange capacities.

Soil fertility on the colonists' lots is generally low except in those which were chosen according to vegetation criteria given by local caboclos. Such soils are exceptionally good (See Figure 20 a) and compare favorably with newly-burnt fields even after one cropping season (Compare Figure 20 a and d). It is suggested therefore, that intensive agriculture

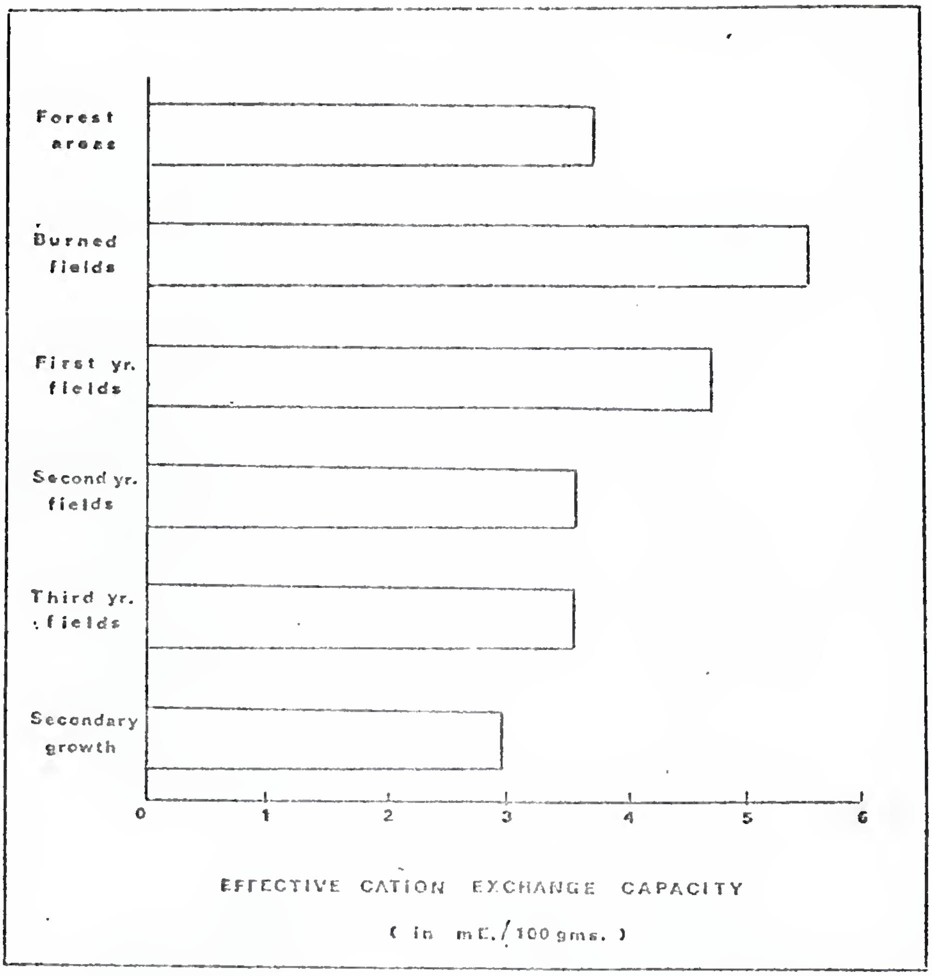


Figure 23. Changes in Effective Cation Exchange Capacity

is not strictly limited by soil fertility in the region. While most soils in the region probably fall in the low fertility category (See Figure 20 c), sizable areas of high fertility soils exist and local caboclos could be consulted to identify these areas. On areas with low fertility, pastures that combine grasses and legumes may be more appropriate than food crops (Mott and Popenoe, 1975:46). As the pasture soil sample shown in Table 36 indicates, calcium and magnesium values were increased after two years on pasture. Over time, one would also expect an increase in organic matter. The most serious soil factor to quality pastures, and to agricultural production in the region, seems to be phosphorus (See Tables 31 to 37). Burning would be the indicated and preparation procedure as it is the only means, to date, to cheaply increase the phosphorus levels. See Figure 24 for an illustration

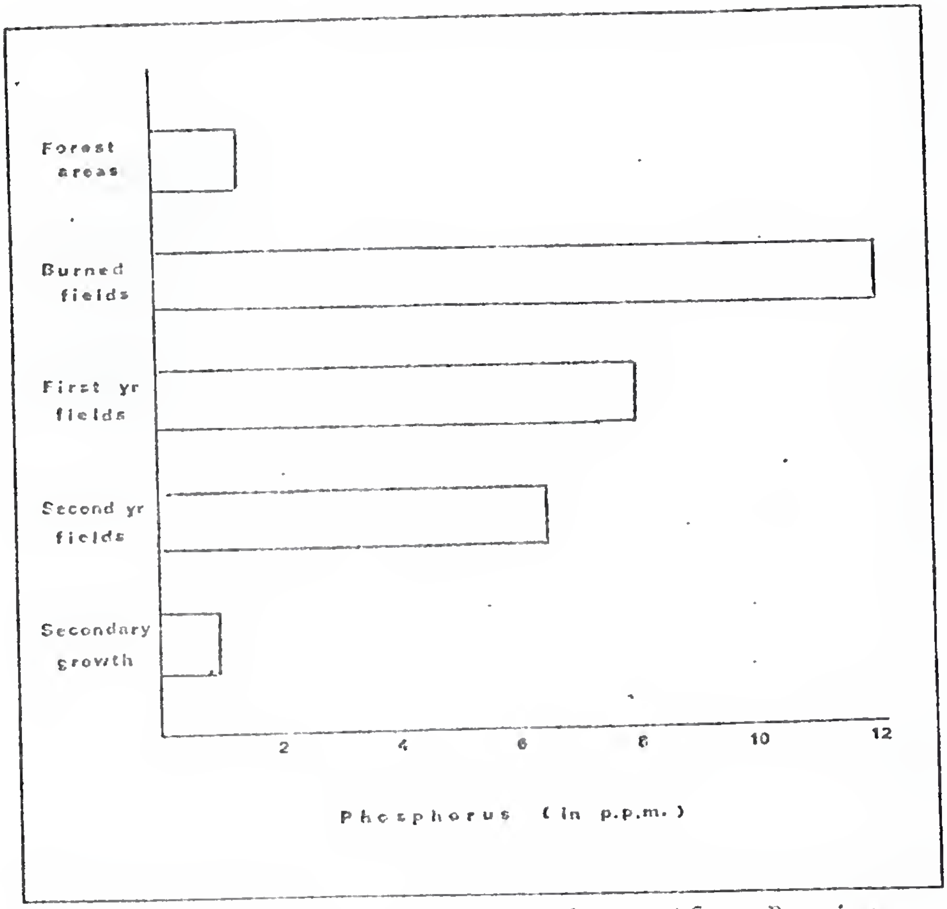


Figure 24. Changes in Soil Phosphorus After Burning

of the benefits of burning and the changes in phosphorus levels with cropping.

System Constraints

Agricultural production in the Transamazon has been limited by a number of factors despite official efforts to prevent it. Selection criteria used were inadequate in sifting out persons without backgrounds that fitted them for farm management. Southerners are generally ex-sharecroppers who were accustomed to depending on a patron, rather than the anticipated entrepreneur-type. Region of origin is not associated with agricultural performance, nor is the length of agricultural experience. The type of experience on the other hand, is much more important in foretelling the likelihood of success in farm production. Persons who previously owned land and/or had management positions do considerably better as farmers in the Transamazon. In the early stages of colonization, the amount of education provides no significant advantage, but over time it increases in importance. In future projects it is suggested that the selection criteria be changed so as to give priority to independent small farmers whose agricultural production has been limited by lack of land and lack of economic opportunity in their home states. Entrepreneurs do not need to be encouraged to come to new areas. Their numbers are even higher in spontaneous colonization projects than in planned settlements.

Besides the management experience of the colonists, limiting factors also include transportation, credit, health and soils. Despite massive investments in road construction, the neglect of side-road construction and upkeep limits agricultural production in this area. A more moderate pace of road-building that provides good access to agricultural lands would serve a doubly beneficial role. First it would facilitate the marketing of production and, secondly, provide sufficient time for construction crews to learn how to build all-weather roads in these areas.

Credit constraints are among the most serious limitations to the production of agricultural surpluses. Most farmers had little credit experience, and the high cost of securing credit severely limited its productive use. Because of the high cost of public transportation, the loans become extremely expensive since they are doled out in six parcels. Simplification of this procedure will increase the actual amount of money available for farm improvement, and decrease the effort expended for all concerned.

Health conditions also affect a farmer's level of activity and, consequently, his income. Increased population density will likely cause a continuous increase in malaria and infectious diseases. Rather than increase the number of buildings devoted to health care, it would seem more effective to emphasize health education. Such education should combine the folk interpretation of disease with the practices of modern medicine (Foster, 1951; Paul, 1955; Fleming-Moran, 1975). For instance, attempts could be made to educate the farmers in the correct use of anti-malarial pills. Otherwise, a farmer can lose two to three months of farm work due to recurrent attacks of malaria. Similarly, mothers could be informed of the first signs of dehydration, a major killer among children who contract gastro-intestinal diseases. By such methods both the time loss and expenditures for illness are decreased, and, in the long run, illness would pose less of a threat to a farm family's productivity.

The Altamira area has soils of both low and medium-high fertility.[10] Road construction and lot assignments, however, largely ignored this variability and as a result, production from the lots of numerous colonists was disappointing. Unless careful identification of fertile soils precedes colonization, project administrators should rely on the local peoples to indicate which soils have good agricultural potential. Slash-and-burn techniques of land preparation should be encouraged, as they are both economical and more appropriate for increasing soil fertility. Phosphorus is the most limiting nutrient in the area and, until fertilizers can be afforded by small farmers extension and credit services should promote the use of crops and pastures adapted to the low levels of phosphorus and restricted amounts of other nutrients. Intercropping practices and cultigens such as manioc which afford good soil protection can also extend the use of particular fields for crop production.

Essentially, the constraints to agricultural production examined here can be overcome by better management of current federal programs. What is crucial is that the decision must be made as to how the various fertile areas are to be used. If there is continued interest in producing agricultural surpluses of food crops then perhaps the better lands should be allotted to independent farmers who can use them most efficiently. The less fertile lands might be used in a variety of ways. They might simply be left as forest reserves, or exploited for their lumber. They might be given to a farmer whose only interest is subsistence crops, or the native fruit trees already well adapted to such conditions. Or an entrepreneur might use the land for native pasture grasses and cattle ranches. If such lands are to be continued to be used by colonists, however, the infrastructural supports such as credit, transportation and others, must be improved.

NOTES

[1] In discussing agricultural constraints, we will use the larger sample of 101 colonists, rather than the smaller sample of Vila Roxa. This larger sample extended over a broader area of the Altamira Project, from kilometer 18 East of Altamira to kilometer 90, West of the city and included several side roads. The 101 colonists were chosen in accordance with the proportion of each state and region of origin shown in the INCRA files on all Transamazon colonists. For instance, as 23 percent of the Transamazon population was drawn from the South, 23 out of the 101 colonists were chosen from this region. In addition the 23 Southerners were all located in widely varying sections of the highway, to avoid overrepresentation of any one area. The same was true for each of the other three regions. This larger sample is less likely to be shewed by any one factor.

[2] Except in the areas of Marajó Island and Roraima.

[3] Since 1948 Andean countries have also met with the same difficulty. It is surprising that budgeting has not been given greater flexibility in the Brazilian Amazon Project (Nelson, 1973:209).

[4] Nelson has pointed out that feeder roads tend to be neglected since main roads carry more political appeal (1973:203).

[5] Most lots are along the main highway in the Itaituba and Marabá Projects, however.

[6] There was a similar occurrence in the Alto Beni II Project of Bolivia. Due to inadequate all-weather roads, there were severe losses from mildewed and sprouted rice (Nelson, 1973:205).

[7] The writer is deeply indebted to Mr. Nigel Smith, of the University of California at Berkeley for much of the data on health included in this section.

[8] The 45 soil samples shown in Tables 31 to 37 were collected using a Hoffer soil sampler. Each sample was collected at 0-10 cm. depth and was made up of at least 15 random cores each. Efforts were made to collect the samples at various stages of utilization within the

same area. The samples were described, labeled and sent for analysis to the Instituto de Pesquisa e Experimentação Agropecuária do Norte. The laboratory methods are included in Appendix 7. Complete soil profiles, using an Eyelkamp bi-partite soil auger, were taken to a depth of 1.80 meters. This material will be presented in a later paper.

[9] Traditionally the cation exchange capacity of a soil has been determined from the amount of the ammonium ion adsorbed by a soil equilibrated with ammonium acetate at pH 7. This method does not distinguish between permanent changes and pH-dependent changes. "The effective cation exchange capacity can be considered the exchange sites that are participating in exchange reactions at the particular pH. On this basis, most mineral soils would be 100 percent base saturated at pH 6. As judged by plant growth, this is a much more realistic manner of expressing base saturation" (National Academy of Sciences, 1972:138).

[10] The Itaituba-Rio Branco region is of very low fertility and would require massive investments to make it productive (IPEAN, 1974). Such areas can best be utilized for forestry, as game reserves, or for tourism.

CHAPTER VII

COPING WITH THE PHYSICAL ENVIRONMENT

Introduction

The cultural ecological point of view attempts to look at man and his environment as parts in interaction, rather than as separate entities. Man's physical environment has undergone modification as a result of his activities, just as culture has been modified by the specific requirements of survival in a given ecosystem. The physical environment is basically the land, with its biotic and abiotic resources. This chapter discusses man's utilization of the Amazonian physical environment and both the changes that have taken place in this environment and in man's socio-economic behavior as a result of this interaction.

Helping humans to cope with life is the specific function of culture. Through culture, human beings adapt to their physical, social and institutional environments (Kottak, 1974:17-19). Cultures evolve and develop specific responses to stimuli from their surroundings which, in turn, are modified to fit the energy requirements of their respective populations (Sahlins and Service, 1960:xi). The problems of identifying the parts and the structure and function of such complex cultural-ecological systems as found in the tropical rain forest, are enormous (Nietschmann, 1973:7). Coping behavior goes on in all areas of life. To completely understand the mechanisms used by any group, all aspects of human life should ideally be examined.

In practice, however, this is impractical and often obscures the major areas where adaptation takes place. It is possible, both practically and theoretically to identify which areas of a group's adaptive strategy are the first to change when they encounter a new set of environmental conditions (Steward, 1955).[1] The Transamazon settlement offers a particularly good laboratory for this type of study. Besides the new immigrant population, which displays a wide variety of adaptations, we also have a population of local residents who have lived in the region for a generation or more. The latter evolved their own set of adaptive strategies to deal with the physical environment, but they must now cope with new social and institutional opportunities. The newcomers, on the other hand, have been in the process of adapting to changes in both their physical and socio-economic condition.

Unlike traditional homogeneous populations such as those studied by Nietschmann in Nicaragua (1973), and Rappaport (1967), and Waddell in New Guinea (1972), the Transamazon population does not yet have a singular or universally accepted cultural response to its social and physical environment.[2] Immigrants from everywhere in Brazil have brought to this new area a stripped-down version of the cultural blueprint that once fitted their region of origin.[3] While all Brazilians share in a "national culture" to one degree or another, regional subcultures also exist which are made up of specific responses to the physical and social features of various geographical regions (Wagley, 1948:457-464).

One of these regional subcultures has developed as a particular response to the tropical forest-riverine environment crossed by the Transamazon Highway. This is the culture held by the Amazonian caboclo

(Wagley, 1952; Moran, 1974). The caboclo population uses a set of strategies adapted to both the physical environment of the tropics and to the traditional social isolation of a region with precarious transportation facilities.

Adaptation to the physical environment of a rain forest, the social environment of a planned village, and to the institutional environment created by the colonization agencies, brought about a variety of coping strategies among the colonists. This is best exemplified by the four groups that make up the Transamazon population. Each of these environments will be discussed separately as they provide distinct resources for man. The ways in which these resources are used by the four groups of colonists will also be examined. Such a discussion will provide us with a view of the evolution of resource-utilization by the farmers.

The Physical Environment

At first, most newcomers saw the forest as inimical to their interests, and cleared areas of land without concern for the natural resources that might be utilized. Resources are not an absolute reality. They are largely a matter of perception (Sternberg, 1973:260-261).[4] Not only must resources be recognized before they can be used, but an adequate strategy for harnessing them must be developed that allows the system to be efficiently operational. Unless this is done, the resource can only be used once. In terms of long-term survival, this is an inadequate solution to human adaptation (E. Odum, 1969).

Traditional populations have long been studied by anthropologists and others. Those whose lives have not been seriously disrupted by

Western civilization show a remarkable balance in their exploitation of their local resources. For example Rappaport (1967 and 1971) described the elaborate homeostasis regulatory mechanism built into the culture of the Tsembaga Maring of New Guinea, which indicated proper times to go to war and engage in conspicuous consumption of taro-yams and pigs. In another case Reichel Dolmatoff (1971) found an elaborate cosmology among the Tukano Indians of the Northwest Amazon. This cosmology linked the reproductive energies of man and animals to such an extent that cultural restrictions limited both the size of the family and the intensity of hunting and fishing. As a result, the population remains stable and has an adequate and easily obtainable supply of protein. In yet another case, the Hanunóo possess an "integral approach" to shifting agriculture (Conklin, 1957). This is a complex system which gives an ample fallow time, provides good soil cover through the use of intercropping, and utilizes hundreds of cultigens and wild plants which diversifies the food resources of the people. Such complex social and ideological mechanisms help maintain the balance between groups and their environments.

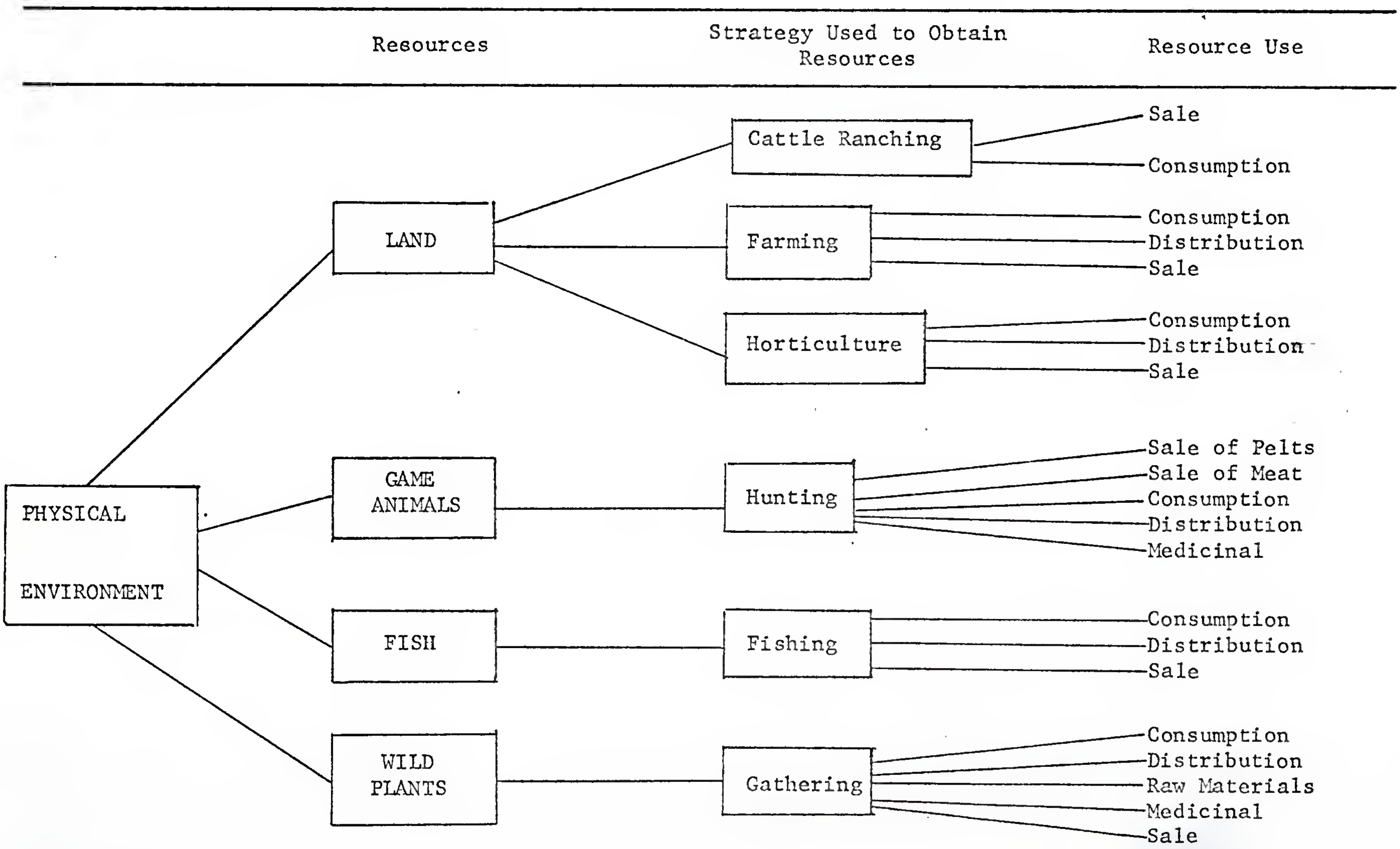
The pioneers who came to farm the Transamazon recognized neither the resources of the forest nor the alternative ways of exploiting them. Their first impulse was to clear the forest and push it as far back as possible. This is evident especially around the houses, where not a blade of grass or natural vegetation is allowed to grow. The vegetable gardens that were planted by some began at least three or more meters away from the dwelling. Some feared having even these plants near the house. They had visions of snakes, scorpions, spiders, and other disagreeable forest dwellers lurking among the plants. They did not distinguish between the types of forest vegetation nor was this vegetation properly related to soil properties. Neither were the forest fruits or game animals recognized or appreciated , with perhaps the exception of deer.

By contrast, the Amazonian caboclo population is very familiar with the physical environment (See Table 38). The resources of the forest are utilized in ways which closely replicate aboriginal adaptations. Hunting and gathering provide protein, mineral, and vitamin food sources, while a fail-safe horticulture based on manioc provides the bulk of needed calories. The crops are planted in small horticultural patches prepared by slash-and-burn methods. The relative isolation of the area has led to a system of self-sufficiency which was linked to a cash economy by extractivism. It is this historical antecedent that largely explains the caboclo's "neglect" of horticulture. Rubber, Brazil nuts, and wood brought good prices, while surplus agricultural production brought less profit and was harder to market. In the traditional Amazon town of Itá, for example, most of the food consumed by the population was and is imported, because most of the families concentrate on extractive activities rather than farming (Wagley, 1964:71-72).

The Transamazon caboclos have come from nearby tributaries, Amazonian gold mining areas, or came as pioneer families when the county made lands available a generation earlier. In these pre-highway years, their activities differed little from that of caboclos elsewhere. Their parents or grandparents had come during the Rubber Era and stayed on after it was over. Rubber collecting along the Iriri continued, for instance, until 1967.[5] With the coming of the highway, this local population sought land titles and close proximity to the main highway artery.

TABLE 38

RESOURCES OF THE PHYSICAL ENVIRONMENT



Caboclo independent farmers were among the first to occupy the Altamira Project lands. Non-Amazonian independent farmers sought knowledge about the area from these caboclos. For example, in the space of two years all non-local independent farmers could recognize the vegetation associated with good and bad soils.

The new social and institutional environments does not detract from or alter the caboclo's adaptation to his physical environment. For instance, caboclo colonists continue to fish and hunt. Although the small streams that cut through colonists' lots do not carry the larger fish species (Honda, 1972; Verissimo, 1970), the use of a simple hook-and-line is rewarded with catches of "traíra" (Hoplias malabaricus Block), some of which weigh four kilograms. Caboclos have not forgotten the use of fishing spears, and a type of fish trap, the cacurí, but no caboclo colonist has been reported to use these methods. They do not use timbó, a general name given to a wide variety of poisonous vines which can stupefy fish in a dammed up stream. The use of such vines is illegal and goes on very surreptitiously if it occurs at all. Catches of fish in the Transamazon are on occasion distributed to friends and neighbors. Fish is neither sold nor used medicinally. Rather it is used largely for family consumption. Much more important in terms of time expended and the resulting quantity of protein, is the hunting of wild game.

Before the highway came, wild game was much more prevalent in the area of Vila Roxa. Caboclos recall killing large tapirs (Tapirus terrestris Linn.) a few meters from their huts. Now, the situation is different. While hunting is not widespread among the colonists in general, their use of the forest for agriculture has driven the game further back into the untouched areas. Tapir is difficult to come by, as is other large game. More rewarding are the returns from hunting white-lipped peccary (Tayassu pecari Link.) and white-collared peccary (Tayassu tacaju Linn.). Appendix 4 lists mammals present in the Altamira area and suggests the possible effect of colonization on the animal population.

Caboclos are conservation-minded when it comes to hunting. The belief in "lucky days,"[6] and other social[7] and legal[8] restrictions which prohibit and discourage the sale of meat and animal pelts tends to diminish the amount of hunting which takes place. Thus, game is not hunted for profit by Transamazon caboclos but only for their own personal consumption and sharing with neighbors. Newcomers, on the other hand, hunt any day, do not believe in bad luck (panema), and in a number of cases sell game meat to supplement their incomes.

Colonists who sell meat are laborer-farmers rather than independent farmers. Hunting game for profit is associated with strategies which emphasize wage labor over work on one's own land. Laborer-farmer families hunt an average of 22 kilograms of wild meat per month, and are quickly approaching the rate of 36 kilograms per month obtained by the native caboclos. Due to their unfamiliarity with the forest, the more urban artisans and entrepreneurs were less successful at hunting. The artisan families hunt an average of only 11 kilograms of wild meat per month. The entrepreneurs, on the other hand, do no hunting at all as their business and ranching concerns leave them little time for even recreational hunting. Both the artisans and entrepreneurs are not as pressed for fresh meat since their high cash incomes allow them to buy fresh beef at Cr$18 per kilogram in the Altamira market.

Most hunting goes on during the late evening and at night. This avoids the lengthy and tiring chase of game that is customary with daytime hunting. The only exception to this rule is the hunting of diurnally active peccary (porcos do mato). Since these travel in bands of 20 or more, the prospect of an exciting and high-yielding chase engages a number of men on a single hunt. Otherwise, hunters leave their agricultural pursuits in the late afternoon and walk to a "waiting point" or espera by the time dusk has fallen. A waiting point is usually located near flowering or fruit-bearing vegetation known to be attractive to game (See Table 39). The hunters tie up their hammocks about three meters above the ground and await for the arrival of game. They wear dark or colorless clothes to avoid detection by the game. Conversation is practically absent. All await to hear the distinct footsteps of various nocturnal animals. When an animal is under their hammock, or eating the flowers or fruit, it is blinded by a flashlight and shot. On occasion, a hunter will pass up a chance to kill, say a "paca" (Agouti paca Linn.) because his wife asked him to bring home a deer (Mazama americana Erx.). Shooting the first available animal would scare the latter from coming to the spot.

After three years of intensive settlement, hunting in the region near Vila Roxa yields mainly small game: paca (Agouti paca Linn.), cutia (Dasyprocta prymnolopha Wagler), armadillos[9] (Dasypus novemcinctus Linn.), and deer (Mazama americana Erx.). Generally, only caboclos will unhesitantly eat monkey[10] although newcomers have been known to eat it in times of need. There are numerous other culturally acceptable mammals in the forest, but they are rarely hunted. Birds are numerous but are currently rarely hunted.[11]

TABLE 39

TREES USED IN WAITING FOR GAME IN NIGHT HUNTING

Common Name	Scientific Name	Flower and Fruit Consumed by Most Species
Matamatá	*Eschweilera* spp.	Yes
Sapucaia	*Lecythis paraensis* Hub.	Except armadillos and birds
Jarana	*Eschweilera jarana* Ducke	Yes
Castanha do Pará	*Bertholetia excelsis*	Only cutias eat the fruit
Jaracatiá	Unidentified	Yes
Tamburí	*Enterolobium maximum* Ducke	Yes
Piquizeiro	*Caryocar* spp.	Yes
Cupuaçú	*Theobroma grandiflorum* Spring	Only deer, paca and tapir eat the fruit
Babaçú	*Orbignya martiana*	Only deer and pacas eat the fruit after cutias open the hard shell
Bacaba	*Oenocarpus bacaba* Mart.	Yes
Açaí	*Euterpe oleraceae* Mart.	Yes
Frutão	*Lucuma* spp. and *Pouteria* spp.	Yes

TABLE 39 Continued

Common Name	Scientific Name	Flower and Fruit Consumed by Most Species
Ninharé	Unidentified	Yes
Toarí	*Couratari* spp.	Yes

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*The above list is a composite list with all trees mentioned by hunters interviewed. None of them included all of the above, but all regular hunters had a minimum of ten trees that they used to seek a point of waiting. It is important to move each night, especially if a hunter has killed an animal at a given spot. A number of farmers were occasional hunters whose knowledge of the forest is very restricted.

Rabbit (*Sylvilagus brasiliensis* Linn.) is hunted only by *gaúchos* from Rio Grande do Sul. Its meat is considered "slippery" (*lisa*) by other peoples and, therefore, undesirable as food. *Capybara* (*Hydrochoerus hydrochoeris* Linn.), the largest rodent on the earth, can be hunted near streams, but it is only rarely found in the Altamira area. Other animals are not commonly used either, such as the *porco de espinho* or *ouriço* (either *Coendou prehenselis* Linn. or *Proechimys guyannensis* Thomas), anteaters (*Myrmecophaga tridactyla* Linn. and *Tamandua tetradactyla* Linn.) and sloths (*Bradypus infuscatus marmoratus* and *Choloepus didactylus* Linn.). While conservation myths are not active except among the caboclo population in this area, it is reassuring to know that food preferences per se exercise a restraining force on hunting. Further, in cases of all illness and the states of pregnancy, post-partum and lactation, game meats are not consumed because they are considered to be dangerous (*remoso*). Indirectly, this acts to lessen hunting intensity and makes game available for a longer period of time as a source of meat protein.[12]

The use of wild plants also differs between caboclos and the new settlers. The latter use only the fruit of the *cupuaçú* (*Theobroma grandiflorum* Schum.), *cacao do mato* (*Theobroma* spp.) and *castanha do Pará* or Brazil nuts (*Bertholletia excelsis*). Even more so than game, wild plants are viewed as dangerous and unknown. Fruits in general tend to be considered "acid" and are especially avoided during disease and periods of weakness. This is true even for caboclos, but when healthy, the caboclos use a variety of seasonally available forest fruits. Caboclos use the fruits of the *açaí* (*Euterpe oleracea*), *bacaba* (*Oenocarpus bacaba* Mart.), *babaçú* (*Orbignya martiana*), *sapucaia* (*Lecythis zabucajo*), *piquí* (*Caryocar* spp.), *cupuaçú* (*Theobroma grandiflorum*), *taperebá*[13] (*Spondias lutea* Linn.), cacao (Theobroma cacao), and Brazil nuts. Appendix 6 contains a partial list of the wild fruits which are available in the Altamira Region.

More often than not, consumption of wild fruits demands a certain degree of processing. The pulp is commonly mashed and mixed with water and sugar to make a juice (vinho). Children rarely wait for this juice and generally consume the fruits in their natural state. Some of the exotic fruits are unusually rich sources of vitamins. Though few have been adequately analyzed, those which have, if eaten, would tend to combat the "vitamin deficiencies" frequently discussed in the literature.[14] For example, taperebá provides a great deal of vitamin C, Brazil nuts yield the amino acid methionine,[15] açaí is rich in vitamin A[16] (Castro, 1967:51-52), and pupunha, burití and tucumã are richer in vitamin A than carrots.[17]

Unlike the other colonists, the caboclo does not view the forest as an enemy that must be beaten back. Rather, it is seen as providing animal and plant foods, as well as being a source of raw materials for household needs. Vines are used for rope, bark for basket weaving, and palm leaves for roof thatch. Cut vines provide potable water, dried straw is used for brooms, and wild herbs provide medicine. Knowledge of these resources is being acquired by outsiders at different rates. Independent farmers use many of these forest resources, followed by laborer-farmers, artisan-farmers and entrepreneurs. These differences in the rate of adoption can be explained by the general characteristics of each group. Independent farmers emphasize self-sufficiency and reliance on the farm. The full utilization of the available resources is a logical strategy for them to adopt. Laborer-farmers have had to turn to hunting and gathering by necessity because of their lack of success in farming. Artisan-farmers, on the other hand, have acquired but a smattering of such knowledge. Their reliance on skilled labor keeps them away from the forest for long periods of time. Entrepreneurs know about such resources but rarely use them as part of their adaptive strategy.

Children are instrumental in the diffusion of such information among the farmer groups. Being less restricted by cultural preferences and far more gregarious, they learn about the local foods and experiment with them. As Stewart and Amerine (1973:68) put it: "When a society changes its food habits, the younger members of the family tend to do so first." If the foods are pleasing, they then introduce these foods to their siblings and parents. It was often noted that when children favor a particular food, the whole family goes along with their preferences. This method of diffusion also applies to medicinal plants, game meats, and methods of obtaining wild food sources. Since children act as the messengers and carriers, they gain a wide exposure to other peoples' habits and, thus to intra-family information on resource utilization.

Strategies in the Use of Resources

With the coming of the Highway, government funds poured into the Transamazon area in the form of minimum salaries, credit, jobs, and larger markets. The caboclos have not wholly changed their subsistence mode but have adapted it to these changing conditions. They first began by increasing the amount of acreage cleared and planted each year to meet the expanded local market for food stuffs. They and the other independent farmers plant this acreage not solely in rice, corn and beans, but diversify their farm produce. For instance, while others await their income from highly seasonal cash crops, independent farmers have a steady year-round production of manioc flour to supply their own needs as well as supply the local market demands. Independent farmers in other words, have become the main supplier of basic consumption items such as manioc flour, tobacco, eggs, pork meat and lard.

Independent farmers are the suppliers of fresh produce for the entrepreneurs' general stores, although they sell to individual neighbors as well. Wives and children of independent farmers work alongside in producing farm surplus for sale, rather than leaving the home to earn wages. "Cottage industries" such as the making of manioc flour and the curing of tobacco involve the participation of both child and adult in a process that is productive as well as socializing. Bank credit is used to acquire liquid assets that would help increase their farm income, such as buying larger griddles for toasting manioc flour, cattle, horses, and powersaws. The exchange of labor among independent farmers is rare. As Nietschmann (1973:133) and Hammel (1969:111) have noted, whenever a community joins a cash economy, wages must be paid even to kinsmen since credit and cash are available to everyone.

Entrepreneurs in the Transamazon use a combination of farm, general store, and transportation services to cope with their new situation. Seldom is their strategy solely based on agriculture. Their main goal is to plant cash crops the first year in order to pay back outstanding bank loans, and eventually buy cattle and/or fencing to get their cattle ranch underway. In the meantime, while most of farm work is done by paid laborers, entrepreneurs are busy providing transportation for people and produce, and operating stores in local villages and along the highway.

The entrepreneur's wife tends either to have a salaried job of her own or to mind the general store. She is capable of keeping the books which record the shop's inventory and credit accounts. Unlike the household of the independent farmer family, which often works together, the entrepreneur family rarely does so. The one exception is perhaps Sunday when both the husband and wife are home, and the man may take his turn at attending customers and credit seekers.

Entrepreneurs vary in degree of managerial talent, but most showed sensitivity to seasonal fluctuations in demand. They are busy during the weeks preceding the harvest season attempting to convince the farmers to sell their whole harvest at a low price. This is often successful since the farmers tend to be low on cash just preceding the harvest and they are often quick to accept the offer of immediate cash. This is especially true among the laborer-farmer group. The entrepreneur then is able to resell the produce at a better price in Altamira or hold on to it for a few months until the market is less flooded and the prices are rising. This was effectively done by a number of entrepreneurs in the area studied. For example, while beans sold for Cr$100 per sack at harvest time, the price skyrocketed to Cr$200 per sack in four to five months. Some who could store their purchased supply of beans were able to sell them and buy as much as 30 head of cattle from the transaction.[18]

Other farmers often ask the entrepreneurs for informal credit. Although the latter try to discourage borrowing, credit is often provided and is an effective ally in the entrepreneurs' control over local agricultural production. If a farmer has a long-standing debt at his store, it is common practice for the entrepreneur to drive out to the debtor's land and buy off his harvest at the lowest price, or carry off some of the farmer's poultry or swine as payment for the debt. The debtor is usually thankful that his debt has been cleared by the forceful creditor. However, in stricly economic terms, the farmer has suffered a net capital loss. His only consolation is that he has personalized credit available whenever he lacks the cash resources to pay for needed goods or services elsewhere.

Both the independent farmers and the entrepreneurs serve as brokers to the two other groups in our typology. Entrepreneurs provide credit and services of various kinds. Independent farmers have become a source of basic food items, information about the land and wages when seasonal labor is required. Both artisans and laborers are clients to the above groups. Their survival is dependent on the success of these brokers who provide a market for both skilled and unskilled work.

Artisan-farmers and laborer-farmers spend a considerable portion of their time earning wages outside their farm. Yields tended to be lower among those who spend considerable time in salaried labor (See Figure 25). Independent farmers by dedicating themselves to farm work, obtain the highest yields in the region (See Table 40). Artisans draw most of their income from skilled jobs and they employ other workers to cultivate their land for them.

A sizable portion of pioneers belong to the laborer-farmer category. Accustomed to sharecropping and/or wage labor arrangements, the management of a one hundred hectare farmstead has brought them landowner status, but no expertise. Laborer-farmers seek credit from the bank to carry out ambitious cash cropping schemes. Such schemes often are beyond their management capacity, or the limitations of the local transportation facilities.

The areas cleared by laborer-farmers are often too large for their capital resources, which generally consist solely of what the bank can

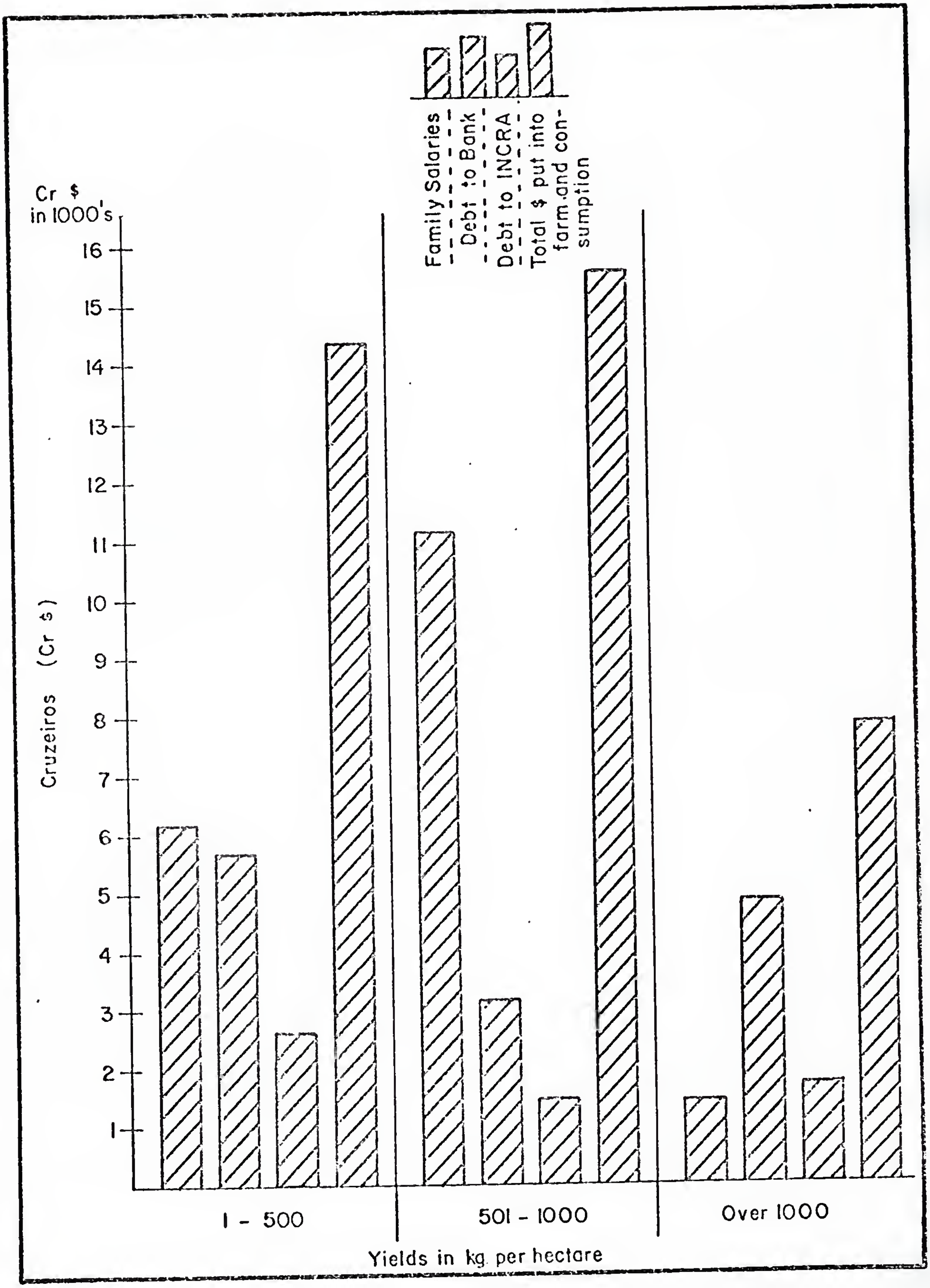


Figure 25. Relationship Between Non-farm Sources of Income and Farm Productivity

TABLE 40

INCOME DATA FOR VILA ROXA FARMERS*

Average	Entrepre-neurs	Independent Farmers	Artisans	Laborers
Salaried Income Per Year	48,000	5,603	18,269	4,500
Farm Income Per Year	5,000	8,798	3,752	2,666
Gross Income Per Year	53,000	14,401	22,021	7,166
Expenses	24,000	8,100	9,190	8,072
Net Income	29,000	6,301	12,831	-902

*Based on a 50 percent sample of Vila Roxa residents.

provide in loans (US$55 per hectare). Since such credit seldom is provided "on time," and they have few savings to fall back on, they are unable to carry out the operations of underclearing, tree felling and burning in accordance with the climatic schedule. Many attempt to augment their cash income by doing odd jobs of manual labor. They have come to depend on the independent farmers, the entrepreneurs, and the local agencies for such jobs. However, as they do not have the skills of an artisan-farmer, they earn little for their labor. To help out, their wives also perform low skill jobs such as washing clothes for neighbors, gardening, and selling eggs. While none of these jobs are very lucrative, nevertheless laborers' wives tend to make a bigger contribution to the total household income than do the other wives in the community.

The laborer-farmers' emphasis on cash crops often leads to the neglect of basic subsistence crops and forest resources for the needs of family consumption. Household gardens are rarely planted in their agro-vila homes because they are never quite sure when they will move again.

Laborer-farmers often indicate that they are "too busy" farming to hunt and fish. As a result, the laborer family's diets are generally poor, and sometimes lack animal protein sources. With their meager cash incomes, and insufficient food production for family needs, the laborer-farmers often need to buy much of their foodstuff, and ask for credit as well. They often have outstanding debts not only with the local entrepreneurs but also with the stores in town. The farm production of many laborer-farmers has been insufficient to pay off their bank loans. Some have been cut off from future credit. In these cases, the farmers often sell their lots back to the bank to cover the loan, and become full time wage earners for others in the area.

The farmer "types" discussed vary greatly in their farm management strategies. The independent farmers produce most of their foodstuffs, fish for their protein and produce household tools and items of prime necessity for sale to neighbors. Entrepreneurs provide transportation services, operate stores with basic inventories, run small cattle concerns, and serve as spokesmen for others with government officials. Their agricultural goals aim at quick returns on cash cropping and subsequent pasture development. Laborer-farmers try to carry out the government directions as they understand them. They plant relatively large areas in the three cash crops, and neglect such subsistence activities as hunting, fishing and horticulture. Meanwhile, they rely on bank loans to pay for the food needs of their large families.

Independent farmers began with a relatively low amount of capital (See Table 41), but in three years they have set up a profitable farm production unit through judicious use of bank loans, family labor, and farm diversification. Their accumulated small assets, in the form of animals and farm equipment, is particularly notable (See Table 41). This increase in liquid assets, by them as well as by entrepreneurs, reflects both a

TABLE 41

CAPITAL, DEBTS, AND ASSETS OF VILA ROXA FARMERS*

Average	Entrepreneurs	Independent Farmers	Artisans	Laborers
Beginning Capital	4,000	678	1,700	140
Average Debt to Bank and INCRA	37,740	12,498	6,462	5,247
Average Liquid Assets	50,500	8,000	370	440

*Based on a 50 percent sample of Vila Roxa residents.

commitment to the farm as a main generator of income, and successful management. Entrepreneurs have accumulated heavy bank debts in their acquisition of cattle. However, such debts could be easily paid off through sale of their other assets.

The low liquid assets of artisans, despite relatively high initial capital and high net incomes reflects their relative non-commitment to the farm (Compare Tables 40 and 41). Very little of their income, credit, or initial capital has been invested in farm equipment or livestock. The Artisan strategy emphasizes salaried labor by one or more of the family members. This group has not achieved the higher yields in the area, but their possession of money has freed them from the deleterious delays in credit to which laborer-farmers have been subjected. Laborers had heavy bank and INCRA debts but low yields per hectare; artisans had low debts but high salaries that gave them "medium" yields; independent farmers had fairly high debts to bank and INCRA, but they devoted less time to salaried labor and obtained high yields per hectare (See Figure 25).

The physical environment, whether natural or man-controlled, offers a varied set of alternative economic strategies. Its use varies according to the households' management background, and their growing familiarity with the physical resources. Agriculture which uses restricted or large areas, extensive cattle pasture, and intensively cultivated gardens may exist singly or as multiple strategies. Any combination of these can be used effectively to make a living in this tropical environment, especially when supplemented with utilization of seasonal forest resources. Table 42 summarizes the distinctive features that separate the various types of farmers in the region. Brokers are distinguished from clients by their high yields in rice, corn, beans and by their ownership of cattle. Within the broker class, the difference between entrepreneurs and independent farmers are the high initial capital and stores of the former vis-à-vis the cottage industry, and the self-sufficient subsistence activities of the latter. The only features which differentiate artisans from laborers are the high initial capital and high salaried income per capita of the artisans. Laborers have begun to acquire a hunting-and-gathering strategy and may start diversified horticulture in the near future, but they are unlikely to achieve proficiency in cottage industries or high yields in major crops for some time.

Human beings do not develop their strategies in isolation, but rather they engage in a set of interactional activities which lead to the exchange of information. In many cases, such information relates to the particular adjustments each one has made to cope with his own situation. From such exchanges come decisions, either individual or collective, as to which strategies have hielded the best results in the physical and socio-institutional environment. Over time, such information becomes widely shared until a certain degree of consensus is reached and produces what we will call a communal adaptive strategy (Bennett, 1972:239).

TABLE 42

DISTINCTIVE FEATURES OF FARMER TYPES

Category	Brokers		Clients	
High Yielding 3 Crops	YES		NO	
Owns Cattle	YES		NO	
Sub-category	Entrepreneur	Independent Farmer	Artisans	Laborers
High Initial Capital	Yes	No	Yes	No
High Salary per Capita	No	No	Yes	No
Stores	Yes	No	No	No
Powersaws	No	±	No	No
Cottage Industries	No	Yes	No	No
Hunts for Food	No	Yes	±	±
Gathers Wild Plants	No	Yes	No	±
Subsistence Garden	No	Yes	No	No

NOTES

[1] Steward's approach to cultural ecology is rooted in his concept of a "culture core" which are the specific features of the techno-economic system. Such features strongly influence the other cultural forms.

[2] Although it is true that a great deal of individual variability is present in all cultures (Pelto and Pelto, 1975), traditional cultures tend to be far less pluralistic than modern societies (White, 1949).

[3] Billington (1967:16) has suggested in his studies of the frontier situation that this simplification of a pioneer's "cultural baggage" is a process that often occurs in migration.

[4] Amazon caboclos perceive areas with liana forests as having more agricultural potential than areas with large-diametered trees. Such selectivity spares these areas with forestry potential from slash-and-burn farming methods.

[5] A rubber trader based in Altamira quit only because the rubber collectors were leaving the rubber trails to hunt the more lucrative jaguar (up to Cr$1200 for each valued pelt). With the prohibition of such hunting by IBDF, the rubber trader predicted that many of these men would return to the rubber trails. However, many of these ex-rubber gatherers are now Transamazon farmers.

[6] Caboclos in the area say that there were days for the hunter (dias do caçador) and days for the game (dias da caça). Tuesday, Friday and Saturday are lucky days for the hunter, while Sunday and Monday are lucky days for the animals. On the latter days, hunting is not rewarding and is generally avoided. Monday, Wednesday and Thursday, are neutral and ambiguous. Even on days when luck is on his side, the hunter can come home empty handed. On such occasions he may become concerned and begin to investigate the possibility that he is empanemado (having bad luck). He will begin to seek the source so as to begin an effective cultural cure (Wagley, 1964:79-80; Galvão, 1951).

[7] Panema is a sort of bad luck in hunting (Galvão, 1951). Panema can be caught by the touch of a menstruating woman on the hunter's or fisherman's articles; through not sharing game with needy neighbors or relatives (desconfiança); through mutilation or abandonment of the carcass of hunted game; and through permitting a pregnant, non-relative to eat his game. Fear for the loss of his protein sources, namely game and fish, seems to be at the root of caboclo beliefs in panema (Wagley, 1964:81; Moran, 1974:148).

[8] The Brazilian Institute of Forestry Development will prosecute a man who sells animal pelts and see that he and his family are expelled from the colonization area for such violations. Game hunting is allowed only for consumption purposes.

[9] The giant armadillo (Priodontes giganteus) is rarely hunted, since it is relatively scarce, although cases were mentioned by hunters.

[10] Large bands of 40 or more howler monkeys (*Alouatta belzebul* Linn.) roam the area. Capuchins (especially *Cebus apella* Linn.) are the monkeys which are most often killed for food. Also found in the area are *sauim* or squirrel monkeys (*Saimiri sciureus* Linn.), *macaco barrigudo* (*Lagotrix* spp.), *zogue-zogue* (*Callicebus* spp.), owl monkeys (*Aotus trivirgatus* Humboldt) and other unidentified species such as *mão de ouro*, *cara branca*, *quatro olhos*, and *cuambá*.

[11] Among the bird species in the area are *Ortalis* spp., *Penelope* spp., *Crax* spp., *Psophia* spp., *Dendrocygna* spp., *Leocopternis* spp., *Anodorhuchus hyacinthinus*, *Ara* spp., *Ramphastos* spp., *Tangara* spp., *Nasica* spp., *Monassa*, spp.

[12] Research has been carried on by Nigel Smith (1975) on the impact of colonization on game species.

[13] The Altamira Region is relatively poor in forest fruits. Among the notable absences are: *araçá* (*Psidium araca* Raddi.), *buritî* (*Mauritia vinifera*), *bacurí* (*Platonia insignis* Mart.), *biribá* (*Rollinia orthopetala*), *ingá* (*Inga* spp.), *jenipapo* (*Genipa americana* Linn.), *muricí* (*Byrsonima crassifolia*), *miritî* (*Mauritia flexuosa*), and *pupunha* (*Guilielma speciosa* Mart.).

[14] The nutritional literature seldom incorporates such fruits both because they are seasonal and people tend to forget to mention them in household food surveys.

[15] This is the amino acid sorely lacking in the make up of manioc protein. This lack has been used to condemn manioc as a quality carbohydrate food (Rogers and Milner, 1965; Moran, 1973:35-36). Brazil nuts are also a rich source of high-quality protein and vitamins (Williams, 1973:630).

[16] Protein and vitamin intake among rural Brazilians is usually considered to be low. Açaí is consumed in enormous amounts in the Amazon whenever available. It is Pará state's favorite fruit as indicated by their saying: "Quem para em Pará para, se toma açaí, fica" ("Whoever stops in Pará, stops. If he drinks açaí, he stays") (Castro, 1967:57).

[17] *Pupunha* is comparable to carrots (8,900 micrograms per 100 grams) buritî and tucumã are many times richer (30,000 and 31,000 micrograms per 100 grams, respectively). *Pupunha* is also rich in fats (Chavez *et al.*, 1949).

[18] The 30 head of cattle would be valued at approximately Cr$60,000 (US$8,500).

CHAPTER VIII

COPING WITH THE SOCIO-INSTITUTIONAL ENVIRONMENT

Introduction

Just as they had to evolve strategies to make use of unfamiliar physical resources, the Transamazon farmers had to develop ways to cope with their social and institutional environment. In some ways, their "social strategies" both monitored and evolved with the adaptations that emerged. The social environment provides the context where a population develops cultural knowledge and provides mechanisms to ensure that such knowledge is passed so that group survival is assured (Spradley and McCurdy, 1975:5). The dynamic process of social life emerges out of the recurrent inter-relations of the various parts of the cultural system. Patterns of interaction, the types of relationships and activities which take place, and the scheduling of social events make up the elements which are indicative of the total social process (Arensberg and Kimball, 1965:2-6). These, then, comprise the topic of this section.

Unlike traditional communities, Vila Roxa is a new community which is still seeking to attain a level of stability and develop a social organization that can better serve the needs of the community members. The fact that it is new raises an ideal opportunity to observe the processes which take place in the earliest stages of community organization, and may raise questions regarding the primacy of certain elements in social organization. Vila Roxa is interesting in that its social life is greatly manipulated by outsiders, that is, government civil servants, who were appointed to organize the community. Its inhabitants are still divided by many regional, religious, and familial factions. How this affects the emergence of leadership from within the community, and the natural formation of community life is examined in this chapter.

Vila Roxa received its first residents in late 1971. Many of these families have since moved out to their lots or to other nearby villages which are closer to their farmsteads. Most of the current inhabitants of Vila Roxa moved in sometime between 1972 and 1973. The village is made up of families which come from eleven different states, representing the North, Northeast, Center-West, and South of Brazil. (See Figure 26). With such a mixture of regional subcultures, the difficulties of homogeneization and social integration are great. However, this heterogeneity has been consciously included in the colonization blueprints as a way of preventing "stifling traditionalisms" from hampering the progress of the new communities (Camargo, 1973:8). The idea was that a new society, modern and progressive in outlook, was to be created among the colonists.

The Institutional Environment

One particular aspect of modern social environments is the way a population deals with its institutional structures. In a planned colonization such as the Transamazon, the governmental institutions are so numerous that they constituted an "environment" all to themselves. This institutional environment makes informational, economic, educational, health, and transportation resources available to the incoming population (See Table 43). As with the physical resources, it is not merely

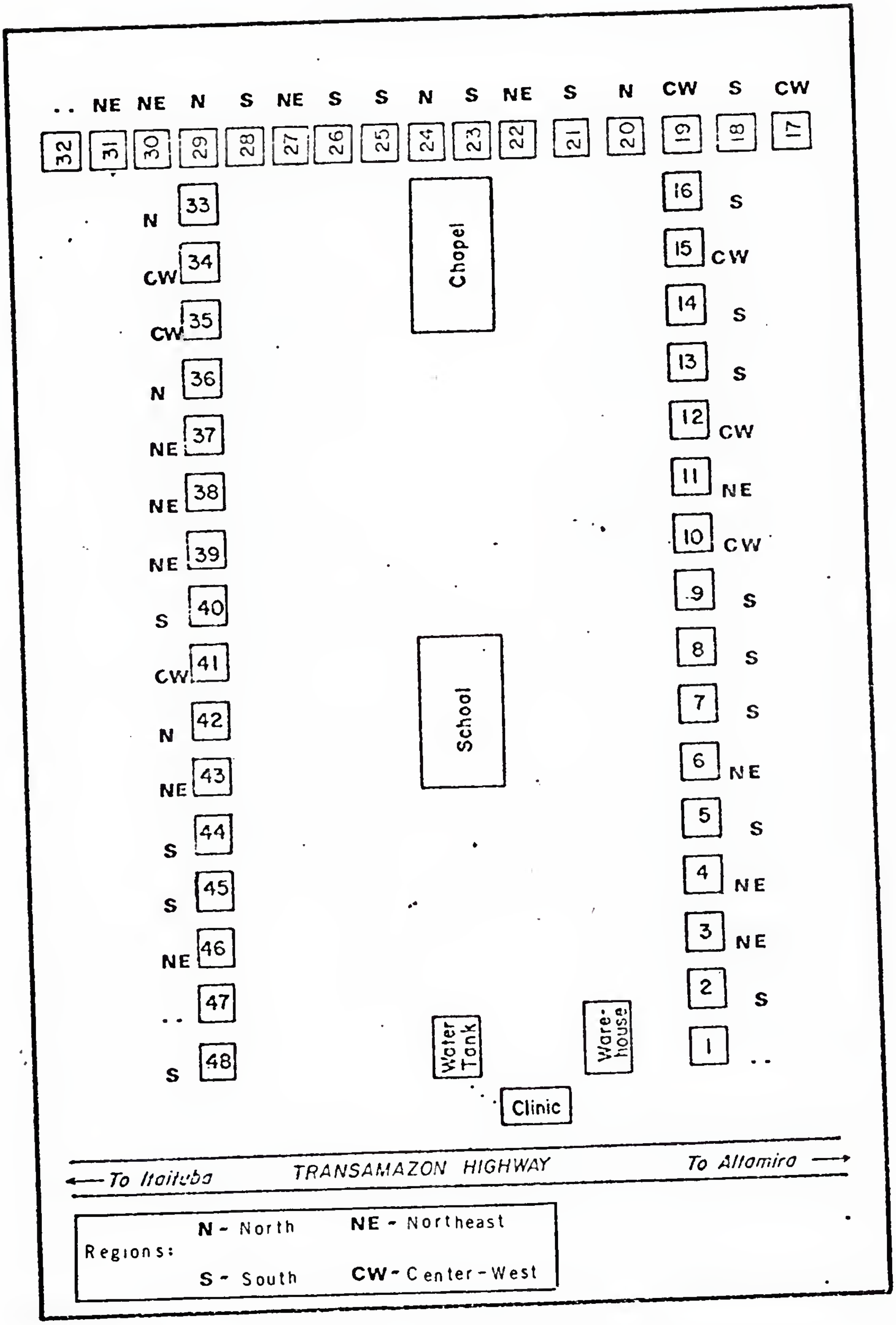
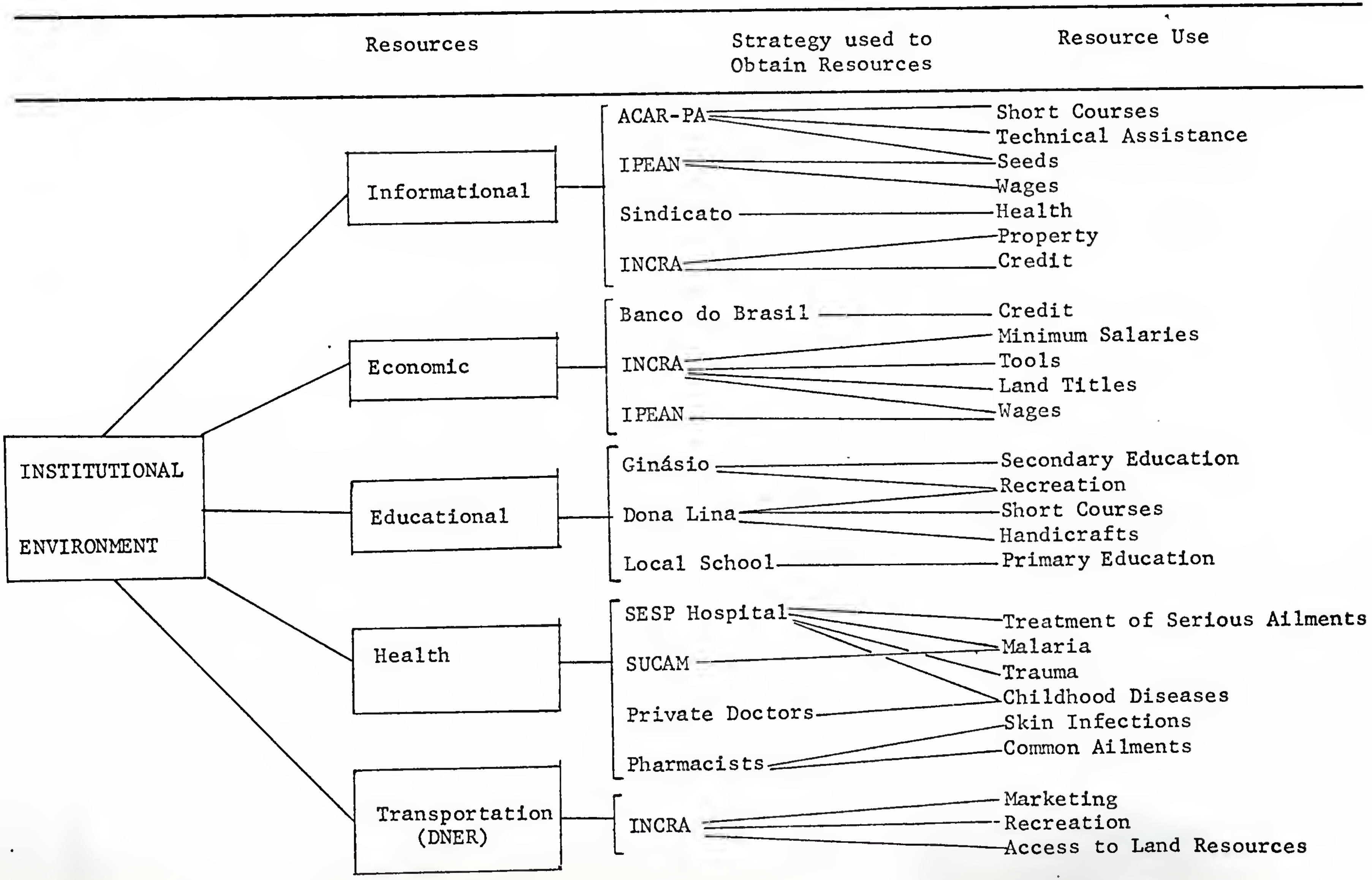


Figure 26. Region of Origin of Vila Roxa Residents

TABLE 43

RESOURCES OF THE INSTITUTIONAL ENVIRONMENT



their existence that is important, but knowledge of how to take advantage of them. Some of the farmers lack the expertise needed to penetrate the bureaucracies that handled the institutional resources, and therefore were unable to effectively use them.

The government provided for outside agents to organize and stimulate community development. Along with the farmers came other "pioneers," agricultural technicians, bureaucrats, extension agents, and social workers. These government employees were either settled in the town of Altamira or in "New Brazil," the larger planned settlement that concentrated government services and personnel. Even while living physically and socially apart from the farmers, they were designated as "official leaders" of the various planned communities.

Social workers ran Vila Roxa's social life according to either urban or textbook premises, especially in the field of entertainment. The passive reaction of the farmers to such an approach was seen by the social workers to confirm their belief that rural people are socially backward or awkward.[1] Thus, much of the social life is artificially induced, Activities are planned and imposed by social workers and circuit missionaries, rather than being initiated by the people themselves. Before entering into a discussion of the evolution of social life in Vila Roxa it would be useful to understand the relationship between government administrators and colonists.

Although the colonization scheme envisioned a nearly egalitarian society, the real differences in education, social level and work experience, surfaced from the very beginning. These differences were expressed in behavioral, physical and social ways. For example, if one looks at the headquarters of government agents in "New Brazil," it is possible to see the delineation of social distance (See Figure 27). The homes of government administrators, technicians, and office employees are all physically separated. The top administrators are located at the rear of the settlement, away from the dusty highway and the bustle of the shopping center and warehouses. They live in impressively spacious, wood-paneled brick houses with elaborately tiered roofs for ventilation and white picket fences. The technicians, who have an equal educational level[2] but fewer years of bureaucratic experience, are on a lower pay scale. Their relative lack of influence is socially marked, again by housing. While constructed of many of the same materials, their houses are smaller and more closely spaced.

Next in line from the technicians are the office workers who also have their own residential sector. They are located near the busy shopping and industrial area to the center of the planned town. While the houses are small like colonists', and lack the brick facing, they still have stained wood paneling and better roofs.

Both administrators and bureaucrats attend a well-equipped social club on their side of town. This social club attracts most of the government employees in the evenings for social intercourse. The bar is open daily. A farmers' social club exists on the other side of town but is opened only for occasional parties. Hard liquor is never sold here, unlike the case of the administrators' club. The colonists' club, like their houses, is built of simple clapboard construction and is open on all sides.

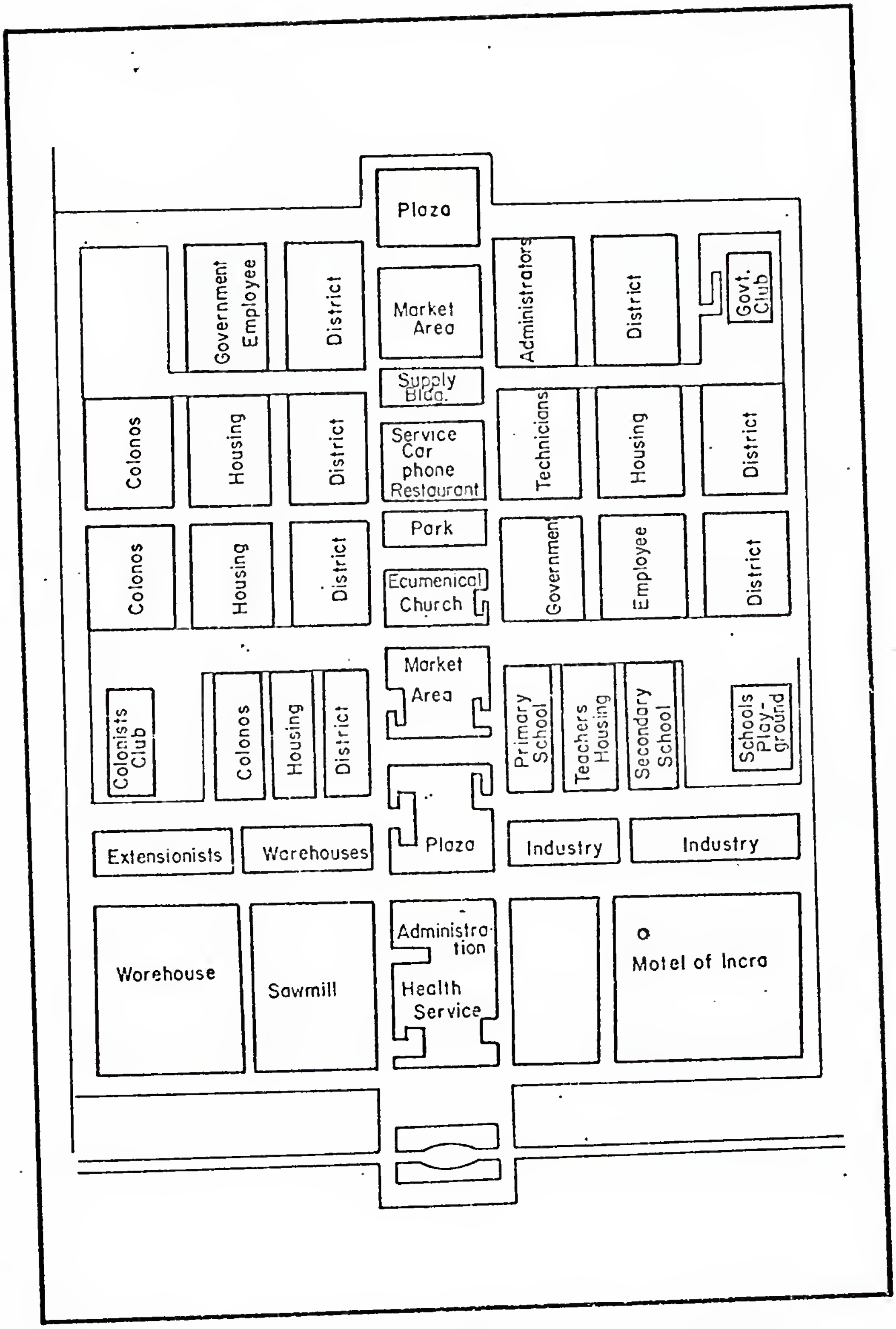


Figure 27. Schematic Agropolis Diagram

Almost all of the government employees identify themselves as dotores, or persons with college-level education in front of the colonists. However, many of the extension agents have had only a brief course which required a junior high school (ginasial) education. Others have taken what is called the curso técnico, a senior high-level program which substitutes for the more classical program (científico). The curso técnico allows a person to enter into civil service jobs in rural areas and is an acceptable background if he or she plans to enter a school of agronomy. The Transamazon farmers are aware of these differences and scoff that "everyone around here is a dotor." This is especially the case when the "dotor" is young and inexperienced in day-to-day rural problems.

Salaries are relatively high among these government employees (See Table 44). To recruit an adequate number of civil servants (funcionários) the government adds a "hardship" bonus (gratificação) to normal salary scales, that is sometimes equal to or higher than the actual salary. Such relatively high salaries are an important input into the local economy. Most expenditures from these salaries go largely for items of clothing, food and drink. Unlike upper classes elsewhere in Brazil, government employees do not wish to get involved in patron-client relationships in the Transamazon. They do not see themselves as "belonging" in the Transamazon and have no intention of staying permanently. Whenever a colonist seeks a favor, civil servants generally refuse personal involvement with the client. This was confusing to farmers who culturally have grown accustomed to seeking protection, credit, and favors (jeitinhos) from persons in high social positions. The client interprets this refusal as an expression of bad will on the part of the civil servants towards the colonists, not as a sign of non-involvement in the

TABLE 44

MONTHLY SALARIES PAID TO GOVERNMENT EMPLOYEES*

IPEAN Agrónomo	Cr$3500 to 5,000 (US$500-715)
INCRA Técnico	Cr$3,200 to 3,800 (US$457-543)
ACAR Técnico	Cr$3,000 to 3,500 (US$430-500)
Social Workers	Cr$2,000 to 3,000 (US$285-430)
Village Mayor	Cr$2,000 to 2,800 (US$285-400)
Certified Teacher	Cr$800 to 1,000 (US$114-143)
Non-Certified Teacher	Cr$300 to 450 (US$43-64)
School Maid	Cr$150 to 240 (US$21-34)
MINERVA Teacher	Cr$100 (US$14)

*Salary given includes the hardship bonus (gratificação).

local affairs, which is the usual intent. For instance, it is often rumored among the colonists that government employees are sons of fazendeiros and have a vested interest in seeing the colonization efforts fail, so that they may come in and buy off the land.

Upper class status is expressed not only by economic level (high income), educational (dotor), and house type, but also by certain mannerisms and dress. As in the rest of Brazil, lower class persons treat their social superiors with extreme deference (Hutchinson, 1957; Harris, 1956; Margolis, 1973:193). By waiting wordlessly outside the door hoping to be recognized, or being hesitant and laconic in speech, most colonists present themselves in a clearly subservient position to the administrator. The administrator, in turn, is sharp and confident, and speaks to the farmer in a staccato manner. Seldom is their intercourse a dialogue; rather it is a monologue with the government employee giving advice to the farmer in a patronizing manner. Rarely are social amenities observed in giving instructions to the colonist. The farmer leaves these meetings not really understanding his obligations and feeling that the civil servants are either useless fixtures of the federal government, or actively seeking to undo the good intentions of the federal government.

The civil servants are also well-marked from the farmers by their use of casual, but fashionable and expensive clothing. Imported blue jeans, halter tops, polyester slacks, clumsy high fashion shoes or designer sandals, are worn universally although such clothing is impractical for the mud, insects and humid heat of a frontier area. Most social workers and technicians are so encumbered by such outfits that their service functions are actually impaired. In only a very few cases did they abandon these trappings of status so to be able to work more effectively. During the rainy season their visiting of the farm families comes almost to a complete stop. Insects afflict the social workers wearing halter tops, and mud dirties their expensive shoes. Motor vehicles are unable to function away from the main highway, and walking through the mud is inconceivable.

Civil servants have another way in which they unconsciously emphasize their status. Walking is avoided; they ride everywhere in their government-issued vehicles, even for distances of only one block. Whether this is done in an effort to avoid the dirt or as an expression of physical separation from the local persons, or merely as an unconscious way of emphasizing their higher status, is hard to determine. Rarely are the farmers given rides in these vehicles. More often than not, farmers have to pay for crowded and sporadic rides in microbuses. The numerous vehicles of the government agencies are restricted either by law, or by individual preferences, to civil service functions. Since the farmer often sees these young technicians driving into town at high speeds, they conclude that these youngsters are but a band of _moleques_,[3] an expression that might reflect the resentment many farmers feel. Since many of the farmers do not accpet or utilize the advice of inexperienced extensionists, they feel the latter's high salaries are a waste of public funds that might be better administered if given directly to the farmer. It should be noted that all these behaviors are not meant to irritate the settlers. Rather, they are part of the cultural make up of young urban Brazilians.

Unconscious cultural behavior on the part of both farmers and government administrators has led to a lack of understanding on both sides. The farmer views the actions of civil servants as conscious efforts to undermine his own efforts. The local government employees view the deferential behavior of many farmers as indicative of social awkwardness, illiteracy, and dependence. Each one plays his role well and fails to communicate effectively with the other. The day-to-day behavior of the civil servants is more fit for an urban area than for a rural one. The behavior of the farmer is "correct" if he were approaching a traditional rural patron.

By far the most significant institution in the Transamazon is the Colonization Agency (INCRA). When the highway project was conceived, INCRA was charged with the execution of the concomittant colonization along its margins. In the first two years practically everything was handled by INCRA: credit, salaries, food subsidies, sale of tools, provision for seeds, medical treatment, and education. Over time, INCRA has been delegating many of the above functions to other institutions, which are more specialized in these given areas. The Bank of Brazil, in conjunction with the extension service, now handles credit. Medical treatment is provided by a number of agencies. Education is now governed by the Ministry of Education in both planned villages and towns. Minimum salaries and seeds are still handled by INCRA but now are distributed through the village mayor's office rather than by the central office. The coordinating body of INCRA now keeps track of lot assignments, topographic measurements, and receiving visitors and newcomers.

Dealing with INCRA is not a simple affair for the farmer. As the bureaucratic delegation of authority is fairly inflexible, if a department head is out, those in lower positions are unable to make decisions, sign papers or even speak for him. The result is that when the farmer goes to seek information or a signature he often finds the needed official is absent, and no one in the office can guarantee when he will return, or act in his name. Several trips may be necessary before the farmer can reach the person he needs. To take advantage of INCRA resources, whether financial or administrative, a person almost needs his own vehicle so as to frequent the agency's headquarters and learn their erratic schedules. The farmer without such transportation has to weigh carefully how many days and cruzeiros he can afford to lose in order to seek INCRA assistance. Many prefer to do without this assistance, so as to avoid the irritation of waiting in offices and losing work.

Partly these problems lie in the long-standing lack of coordination among government agencies in Brazil. One might expect that, even if there is such poor delegation of office authority, at least the farmer could leave his document in the office and return assured that it would be signed and processed in a reasonable period. Or perhaps the extension service could deliver the documents to the farmers instead and take the opportunity to carry out some of their own interview work.

Mutual suspicion and a lack of cooperation are the distinguishing features which mark the interrelations of the public agencies, as indicated by the relations between the Bank of Brazil and INCRA. The President of the Republic charged the Bank with providing credit to farmers, using the land title as collateral. Since the Bank of Brazil is a commercial bank and not a credit agency, the extension service was given the job of supervising credit, making the plans, and approving payments.

The Bank of Brazil, as such, is busy making a profit. Subsidizing inexperienced small farmers is not an investment they would freely make, unless it were ordered by a Presidential decree. Thus, they deal as little as possible with the small farmer, restricting their role to paying loans on the approval of the extension agency. Bank employees never thought of visiting agrovilas nor of offering short courses or lectures on how to make the most of one's bank credit and to decipher the official credit papers which are received by all colonists. Most farmers seeking regular credit from the bank find their applications rejected, except for a small number of aggressive entrepreneurs who deal directly with the bank manager on a first name basis. The bank manager in turn shows preference in these entrepreneurs whose interest in cattle production is attractive to the Bank.

Persons who seek financial aid in establishing small commercial operations of say, manioc, tobacco, and other regional cash crops, are also rejected. No effort is made to educate them on how they may develop a plan which is attractive and profitable for the Bank. Cattle enterprises are more welcomed. If the farmer can demonstrate that he has a reasonably good pasture and corral, money for barbed wire, fencing, and purchase of more cattle is not hard to come by. Whether this is due to the Bank's recognition of the general ignorance concerning agricultural production in the lowland tropics, or whether it reflects the generally accepted belief that cattle production is always profitable, is hard to say. The effective result is that farmers found few alternatives to develop their capital resources even in a frontier area, due to shortsighted institutional policies.

As indicated in the previous chapter, health can also be a serious constraint to agricultural production in the Transamazon region or regions anywhere where infectious disease has not been brought under control. Vila Roxa residents enjoy relatively good health.[4] The government provides health resources through the Public Health Service (SESP), the Malaria Service (SUCAM), and mobile units that visit roadside villages once a week. Two private doctors and two dentists (SESI, 1974) attend the town of Altamira as well. Five pharmacies serve the Altamira area, although their supplies run low in the rainy season. The pharmacists are reluctant to import medications by boat due to high losses from breakage. Because of the numerous patients that SESP had to handle, government doctors treat patients curtly to avoid lengthy conversations. As a result, patients feel their illness is sloppily diagnosed and the prescribed cure will probably be ineffective. Many colonists have limited their visits to government doctors for this reason and have turned to home remedies as an alternative solution to their ailments.

In Vila Roxa, for example, even the nurses's aide at the local health post has little rapport with the village residents. This may be due to what the colonists call her "closed character" (cara fechada). Most of her family and friends are in Altamira, and girlfriends come out occasionally to Vila Roxa to stay with her. Normally the nurse's aide administers first aid treatment and vaccines, and keeps a record of the diagnoses and treatment prescribed during the weekly visits of the mobile doctor. Whenever pharmaceuticals are not available from the post's supply, she sometimes refers patients to other colonists who can supply them with herbal cures. Those living deep in the side roads rather than in planned villages also find it difficult to travel the long distances if they are already weakened by disease. Choice of location, again, determines one's access to a resource which can have major significance in one's adaptation and survival in the area.

Vila Roxa has a two-room primary school which is staffed by four teachers. The teachers are not outsiders but are family members of Vila Roxa farmers. The school is a rich source of information, since it gathers together a large number of children who are important disseminators of knowledge about plants, animals, and other families in the area. The school day is split into two sessions, the first two grades meet in the morning, and the third and fourth grades meet in the afternoon. It is interesting to note that the textbooks selected for the school teach a great deal of the folklore of the Amazon, especially caboclo myths about the forest. The children memorize such myths as part of their school experience. Whether such myths will become truly integrated into their knowledge as they grow up in the Amazon remains to be seen.

Those who complete the four years of primary school can then to go on to ginásio (junior high) in Altamira. The factors which tend to limit the use of further educational resources are distance and money. The microbus that makes the trip to the school each evening travels only along the main highway artery, and does not even pull into the village. The only ginásio operating in town is a Catholic school. Therefore, an annual tuition fee of about US$15 is paid, uniforms have to be sewn and transportation must be arranged (US$15 per month per person), all at a prohibitive cost to most families. Only families in which the teenagers pay their own way could afford such expenses. Despite the abundance of government vehicles in the area none has been made available to provide a greater number of youths the opportunity to get a secondary education in Altamira.

A public junior high school has been built in town since 1973 but the classroom furniture has not arrived from the manufacturer in Southern Brazil. It is possible that use of this school may reduce the costs somewhat, but it is still the high cost of transportation which most limits the colonists' access to educational resources beyond primary levels. Ten teenagers in Vila Roxa made the daily trip to Altamira in 1974 and two more are attending in 1975. It is interesting to note that half of the students are Pentecostal Protestants who value their education enough to overcome their religious resistance to attending the Catholic school.

For those with fewer financial resources, short courses taught locally are available. Courses in electrical training, in handicrafts, in raising fruit trees, in cattle and swine husbandry, and in cacal cultivation are taught in Vila Roxa and in a school four kilometers away from the village. The exploitation of educational opportunities is limited only by its physical unavailability, or cost. A number of families choose to live in the village, rather than on distant lots, because they wish their children to have access to education. This positive choice for education has a negative effect in that it reduces the availability of family labor at the farm site. Completion of junior high school is an important avenue for social mobility since it opens opportunities in well-paying jobs in the government bureaucracy, and is required for entering technical schools (curso técnico) or teacher training (pedagógico).

The presence of government agencies also made a considerable economic contribution to many family budgets in the area. Although they import most of their technical personnel, the government opens its lower-level jobs to local people. These are sometimes filled by farmers' children who, in this way, earn sufficient wages to help their families and advance their own education. This is especially the case with the agronomic experimental station near Vila Roxa which employs up to twenty teenagers and young adults as secretaries, field workers and mechanics. Without this input of salaries, Vila Roxa would be much poorer and its population less optimistic about the future.

Utilization of the resources of the institutional environment calls for knowledge that is learned in cities and managerial positions. Entrepreneurs are, therefore, most successful in dealings with institutions, followed by artisans who provide needed skilled labor to government agencies. Laborer-farmers have been unsuccessful in dealings with institutions and have begun to depend on the entrepreneurs to plead their cases. Independent farmers may deal directly with institutions or use the services of the entrepreneur. The latter does not imply the same degree of dependence since independent farmers tend to be in fairly stable economic condition and own considerable assets. This frees them from debt-obligations that also entail control over one's activities.

Entrepreneurs, therefore, have taken full advantage of the current institutional structure. They have done well and have gained leadership status in Vila Roxa as a result of their commercial and institutional maneuvers. Independent farmers, too, have overcome some of the bureaucratic bottlenecks by asking for more credit per year than the standard Cr$2400. This has effectively lowered their costs in obtaining credit. Since this group is the most agriculturally productive, it is important that such costs be reduced so that more government funds are used for productive purposes.

The provision of institutional services was an impressive effort to overcome the problems that had stifled the progress of other colonization efforts. Nevertheless, if one recalls the constraints to agricultural production, the are, in most cases, related to institutional failures. Quality road construction and completion of side roads are essential to the production of marketable surpluses. Provision for credit at low cost means not only that the interest should be low, but that costs of obtaining it should also be minimal. The decline of farm work occasioned by poor health can be reduced by readily available medication, and paramedical assistance at the village and farm level.

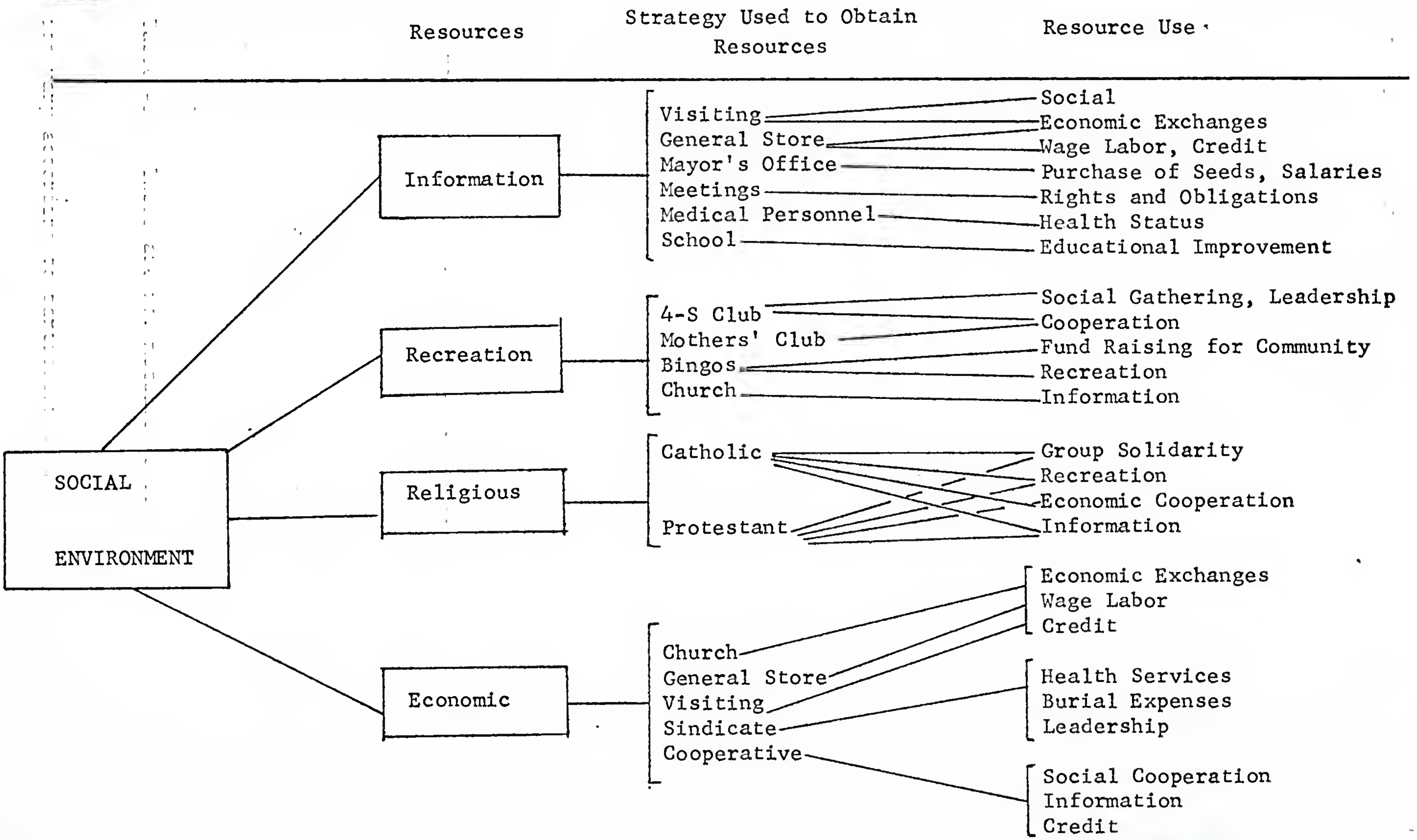
Given the serious limitations, both cultural and physical, to full utilization of institutional resources, it would seem more economical to provide such services gradually. Brazilian administrators claim that part of the inefficiency is due to the lack of enough personnel to provide adequate services. This in turn is related to the limitations of budget placed upon each institution. However, if one views the colonization agencies in toto, the amount of personnel and funds in the Transamazon are impressive. In order to provide adequate services, planners need to establish their priorities in the delivery of services. The choices of such priorities will be discussed in the next chapter.

The Social Environment

The inhabitants of Vila Roxa had several informational, recreational, economic and religious resources available to them in their village (See Table 45). These are not mutually exclusive categories but rather inter-related social activities. They are exploited in a number of ways which vary according to particular cultural and personal attitudes.

TABLE 45

RESOURCES OF THE SOCIAL ENVIRONMENT



Social interaction is systematic behavior between two or more people and such interaction is "the primary means by which all human needs are met" (Spradley and McCurdy, 1975:116). Arensberg and Kimball have noted that time is a necessary requirement for all human groups to develop systems of relations which give stability and meaning to human life. On the formal level this is accomplished through schools, churches, clubs, and organizations. More informally, this is achieved through neighborliness, mutual interests, and cooperation (1965:138-139).

The earliest social bonds were those created by families which traveled together to the Transamazon. These families continue to visit each other. The men engage in the exchange of labor and farming information, and the women discuss gardening, children, home remedies, and the problems of home economics. The few extended kin groups which came, arrived together, so that these multi-head families had both kin ties and companionship as basis for visiting one another. Visiting is used to maintain such social bonds, to offer articles for sale, to exchange food, and to find out about wage labor opportunities in the area.

Lacking extended family networks, extensive compadrio ties,[5] and a traditional village environment with drinking establishments, tiny market stands, and other places for popular gathering, the pioneers have utilized more basic relationships to provide a degree of social cohesion. Since the colonists were brought in groups (turmas) from their home states, friendships were formed in transit, and the families helped each other adjust during the first difficult months. Many of the men of these groups chose their lots together in the same side road and now walk to their fields joking and discussing farm plans and local gossip. Figure 28

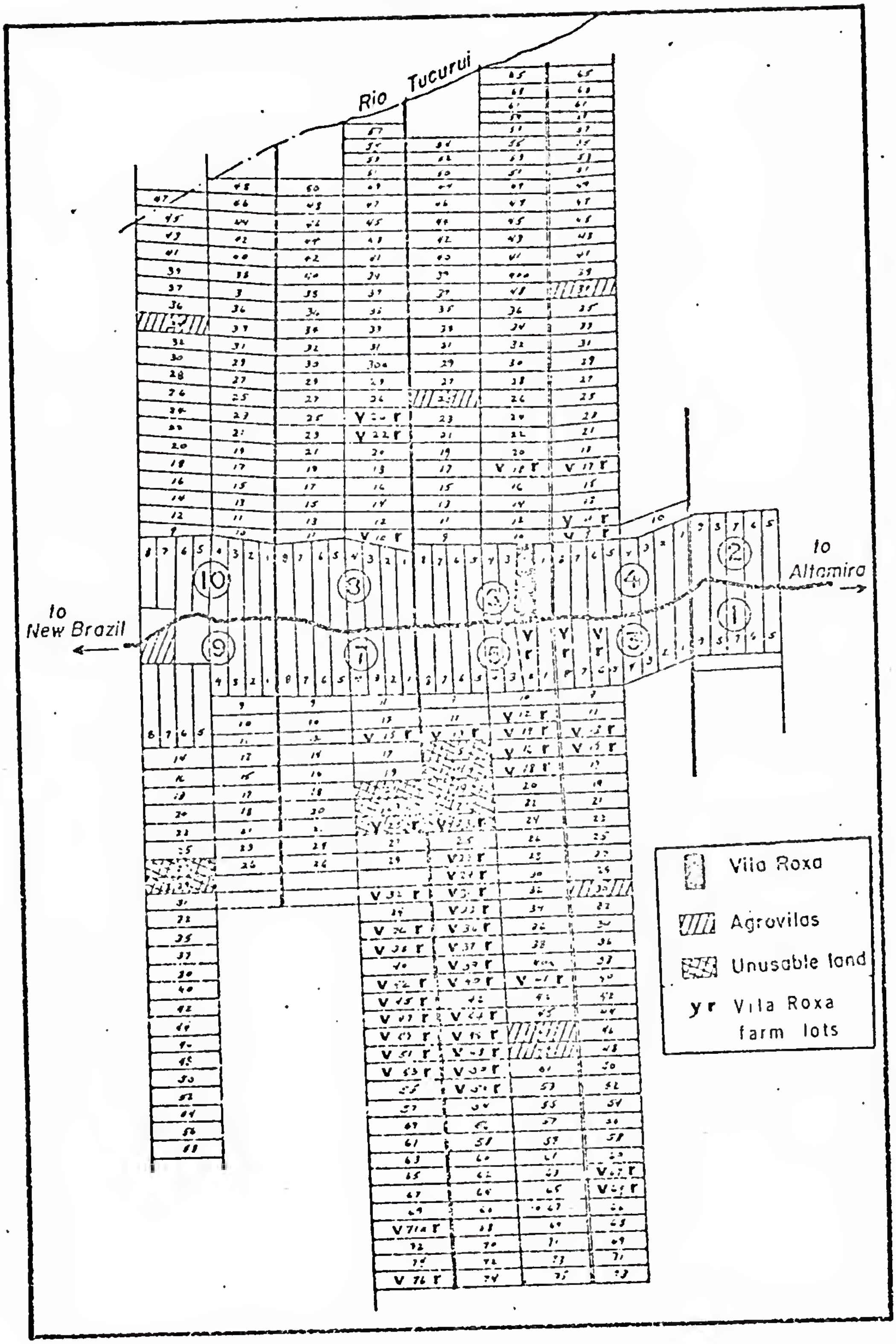


Figure 28. Distribution of Farm Lots of Vila Roxa Residents

locates the lots of Vila Roxa farmers. It has taken more than three years for some farmers to seek broader social networks than those of their original turma. Few of the farm families knew each other before beginning the trip, but the experiences which brought close contact and great expectation have created lasting bonds and solidarity among them. Facing an unknown environment, the farmers clung to each other for a certain measure of security and common experience. Region of origin has provided some sense of social cohesion. The typology of farmers, on the other hand, while useful in describing agricultural behavior, is not adequately designed to explain social behavior.

The central meeting place in Vila Roxa is the village's general store. Since soft drinks and beer are sold, the store is used by teenagers as a meeting place, by the men as a bar, and by the women as a visitation center. There are times of the day during which each of these groups would dominate. Women and little children are there during most of the morning and early afternoon hours. Teenagers and young unmarried adults come after work during the late afternoon and dominate the premises on Sunday mornings and afternoons. The men stop by early in the morning on their way to the fields, or late at night. The local football game on Sunday serves as the social divider. As the young men leave the store on Sunday to go to the game, the married Protestants take over the store. The Catholic adult men also go to watch the game, and in a few cases to participate.

The store is a source of informal credit. As a gathering place, it also serves as a "clearing house" for arranging seasonal wage labor, buying-and-selling, or learning of the latest events in Altamira or "New

Brazil," where government offices have been centralized since mid-1973. The store's radio provides a means of contact with the outside world and noise to drown the pervasive quiet of life in the village. In more than one way, the radio's music and news minimize the isolation of rural life in the Amazon. The store owners have an optimistic outlook on life in the region and their encouragement has helped to cool the hot tempers of many.

One of the houses nearest the highway in Vila Roxa serves as the village mayor's office (See Figure 29 for location of village specialists). This small office acted as a post office, a central distributing point for government-selected seeds, and a local contact with an INCRA official, the mayor. Although complaints are frequently heard in other planned villages about their mayors, Vila Roxa residents appreciate theirs. The mayor makes sure that the central area is kept reasonably cleared of vegetation and has arranged, on occasion, for a small rice and castor bean crop that is left for residents to pick. Vila Roxa residents regard theirs as the most attractive planned village in the region, and give the credit to the mayor.

Also unusual is the fact that the mayor takes trips deep into the side roads to check on the farming progress of colonists. According to colonization plans, extension agents and village mayors are supposed to keep a careful scrutiny of the settlers' performance. Vila Roxa's mayor is one of the few who ventures into the side roads to perform this function. Though his reports are not always favorable, he has gained the colonists' respect as a result of his "courage." The mayor bought a relatively large tract of land (3000 hectares) at the end of the side roads in an area which has been set aside for cattle ranching. He has

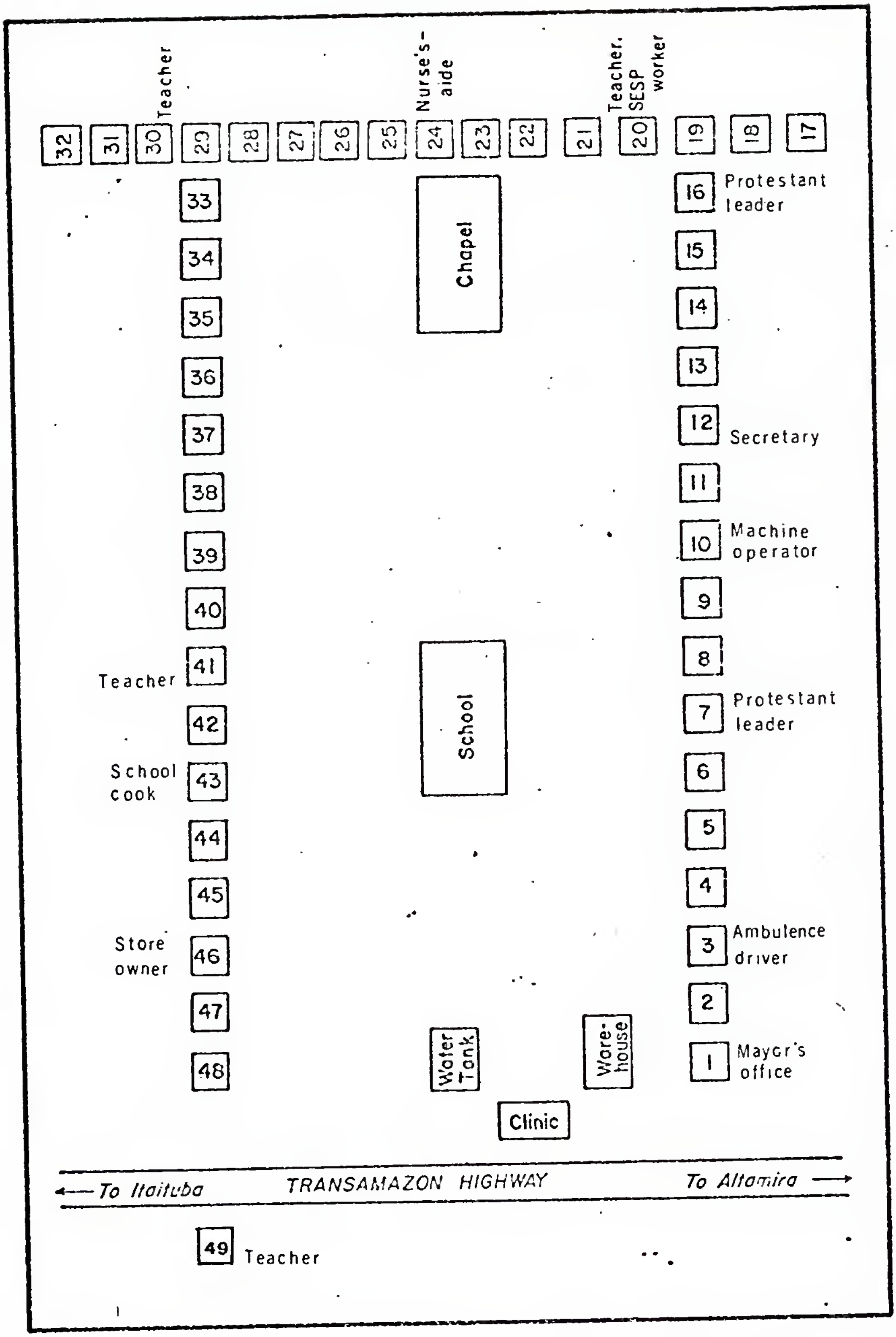


Figure 29. Various Occupations Found in Vila Roxa

already indicated his interest in hiring some of the nearby settlers for labor. He has even extended some informal credit. Therefore, his trips have a mixed purpose, and he may be laying the necessary groundwork towards becoming a patron to a group of eager clients in the side roads near his land.

The mayor is in his Vila Roxa office only a few hours a day. However, the office is open during working hours and is run by the daughter of a Vila Roxa farmer, employed by INCRA as a secretary. She has excellent rapport with the mayor. The selection of this secretary may have been based partly on the fact that she came from the same State as the mayor himself. She has a third year ginásio education and is capable of handling the office's business. She knows where everyone lives, what they plant, how they are doing, and current operating policies of the colonization agency. Therefore she is in a position to be helpful to farmers seeking information. Being a colonist's daughter, she does not maintain the type of social distance characteristic of other government representatives. Her information is given in terms that the farmer can understand and they feel free to ask further questions if they have not understood. While she does, indeed, aspire to a better government job and to acceptance among the urban government agents, she shares too deeply the farmers' plight and serves her informational functions well. The mayor knows this and lets her handle practically all office business.

The mayor's office is also used to sell the seeds selected and distributed by the government. Here the colonists obtain the mayor's signature so that they can claim their minimum salaries which are paid by the Altamira branch of the Bank of Brazil. This gives the mayor one further opportunity to keep in contact with the village population.

Some of the social gatherings in Vila Roxa have a recreational, as well as an informational role. The general store, home visiting and school serve this double function. However, many group activities are directed by government employees. Two such activities organized by the ACAR social workers are the 4-S Club[6] and the Mothers' Club. Catholic youth participate in the 4-S meetings, as well as a number of Protestant teenagers, despite their parents' disapproval of such "frivolous" activities. The youth hold evening meetings once a week in the interdenominational church building to talk, play games, and plan dances. The club provides a chance for village youth to gather and is an excellent opportunity to develop their leadership and cooperation skills. However, as the ACAR social workers are present at every regular meeting the youngsters often deferred to their authority, and effectively let them take over the meetings. The first president was the previously mentioned mayor's secretary who was well known to both the social workers and the teenagers. There were no complaints heard from the boys during her period of leadership despite her relative youth (15 years old) and sex. She was more self-assured and interested in social events than were the boys. But within three years the boys have gained enough self-confidence to take over the leadership.

The club, unlike its United States prototype, has minimal agricultural objectives, despite idealistic goals in the by-laws of the organization. A small fruit garden (horta) and a black pepper stand belong to the club as educational and money-making projects. However, it was nearly impossible to get the group to volunteer to work in them. A short newsletter is published by the social workers twice during our stay in the village. It was largely the work of the club president and the social workers, and included songs, gossip about people, and reports on the various social events in the area during the previous period. Such a situation leads to complaints about the paper's contents everytime a new issue appears.

The 4-S Club has organized a more or less autonomous soccer team which practices often and plays against a similar team made up of the young men who work at the agricultural station. While the experimental station workers also belong to the 4-S Club, there are enough young men to make two ample teams. The overlapping social groups keep the rivalry on a friendly basis rather than a serious one. The mayor and some of the younger colonists even play on the 4-S team.

The Mothers' Club is organized by the social workers to teach women about hygiene, vegetable gardening, nutrition, and baking and to develop their community awareness. It serves as a chance for the women to get out of the house and gather socially. Like the 4-S Club, the Mothers' Club is mainly frequented by the Catholic members of the village. No handicrafts or other items are made for money raising projects, as occurs in other areas of Brazil. The club owns an oven and women take the opportunity to make their cakes in it. As in the 4-S Club, the social workers try to cajole the club members into speaking up and taking initiative in the club activities. All this is to no avail. The membership is erratic; many colonist women feel that they do not gain anything new from the simplistic lectures, and that the "socializing" was worthless. In the two years of its existence, the club has never had enough cohesion to elect officers. Meetings are not called unless the social workers arrange for them. Most of the regularly attending members are women who either have few children or had responsible older children who could care for the house in their absence. They do not make many trips to their lots. Therefore, have more time to attend the meetings and engage in the crochet and other handicrafts that are taught.

Another important source of information are the infrequent public meetings held by the social workers and extension agents. Every few months the INCRA or ACAR social workers call general meetings to inform families of recent government rules that affect them. For example, one meeting was intended to force final decisions by farmers on whether they were going to buy the Vila Roxa houses or move permanently to their lots. Such meetings are not effective in bringing about a dialogue between government institutions and the farmer. But insofar as they gather the farmers together, they serve the broader purpose of informal information exchange after the meeting is over. Farmers feel that the social workers are not really interested in their welfare, and note that the agents rarely visit them at home.

The extensionists also give short courses on various aspects of crop production and animal husbandry. However, these classes are more academic than practical. The information came from the extensionists' own training and has not been adapted to local conditions.[7] The courses are usually attended only by the teenagers of the 4-S Club who view this merely as an opportunity for a change of scene and possible recreation.

The earliest community-initiated social events were the soccer games, and occasional bingos or raffles, all of which generally occur on Sundays. The games of chance are used to raise money for a variety of purposes, such as new uniforms for the football team, school equipment, and money for the patron-saint feast. They are useful both as money-raising events and as giving the settlers confidence in their organizational capabilities. The bingos are well-attended and generate interest among all segments of the Catholic population. School age children are sent around selling the tickets, and each week's prizes were the topic of conversation several days before and after the event.

One important source of social cohesion is common religious affiliation, especially among the Pentecostal Protestant sects (crentes). Two groups predominate, the Assembly of God (Assambléia de Deus) and the Brazilian Christian Congregation (Congregação Cristá no Brasil). Both are made up mainly of migrants from Paraná, and together comprise one fourth of the Vila Roxa residents (See Figure 30 for denominational distribution of village residents). Pentecostal sects tend to attract low education, low success farm workers (Willems, 1967:189) who find comfort in the emotionalism and hope provided by the services. Many of the crentes who came to the Transamazon were somehow influenced by the church communication network. Often one member of a Pentecostal sect came to the Transamazon and would write of his initial experiences to the pastor back home, encouraging other congregation members to come. In this way, the news of available land was spread, and fears were calmed about life in the Amazon.[8] In one case the crentes of one town of the state of Paraná migrated together and eventually colonized a side road along the Transamazon. It is possible to find a planned village, not far from Vila Roxa, with nearly half of its population belonging to one Pentecostal sect.

These Protestants, in addition to their evangelical zeal, forgo the "wordly pleasures" of smoking, dancing, drinking, wearing "extravagant"

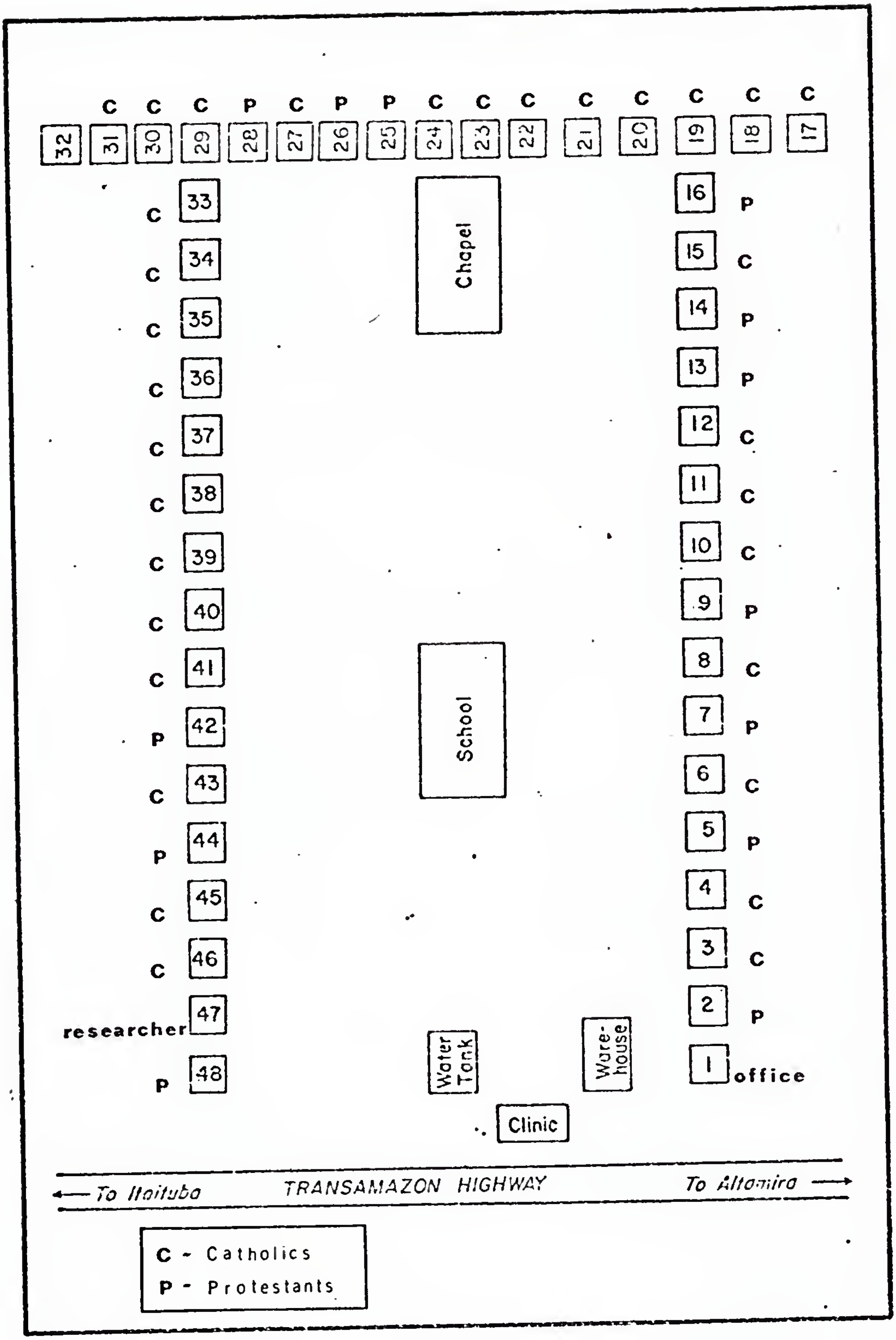


Figure 30. Religious Affiliation in Vila Roxa

clothes and participating in sports. This tends to set them apart from their Catholic neighbors. Protestants generally do not join in the 4-S Club or the Mothers' Club, perhaps because the meetings are held in the interdenominational church building. To them it is the "Catholic Church," and in the words of one Protestant lady, the building represents "the gates of hell." In school, conflict occurs when the Catholic catechist comes to teach religious songs and when teachers encourage the children to dance and sing at recess, which is not liked by the Pentecostal parents. Neither are the Protestants involved in the formation of compadrio or fictive kin ties, a primary bonding mechanism in Latin America. Unflattering stereotypes also add to the schism. Protestants view Catholics as people with little "religion," who are frequently drunk, beat their wives, and squander their money on loose women, smoking and gambling. Catholics, on the other hand, see crentes as illiterate Bible-mongers, and they quickly tire of the crentes' holier-than-thou attitude.

Such feelings of antagonism are openly expressed, but as one group feels "sorry" for the other little hostility arises to get in the way of community cohesion. Such feelings do, however, serve to unite the respective groups in their opposition to each other. The crentes hold weekly prayer meetings in their own homes and refuse to use the "interdenominational" church building in the center of Vila Roxa.[9] They also form work parties to help each other in the fields, and they are currently active in organizing a farmers' cooperative.

As yet the Catholics are lacking in comparable religious unity. Rural Brazilian Catholicism is made up of a number of varieties, and each region varies significantly in its ritual practices, patron-saints, and festivals. In Vila Roxa one finds a blending of many such traditions from the North, Northeast and South, but none has clearly dominated. There is not yet a traditional rezador or beata (lay religious leaders). An Austrian priest comes once a month to say Mass. On the other Sundays, simple prayer services are led by a catechist who has been appointed by the priest. The choice of the catechist was not very fortuitous since the man does not live within the village. Therefore, he is somewhat outside the social life of the community.

Neither of the two religious leaders encourages the selection of patron saints, nor the creation of a lay brotherhood (irmandades). After three years, during a family baptism celebration, a small group of Northeastern Catholics decided that it was high time to choose a patron saint, to have an auction (leilão) in his honor, and to celebrate his feast day. Until this time no one had even held a traditional post-baptism party, much less given any serious thought to the choice of a patron saint.

All these Northeasterners had come from the state of Rio Grande do Norte. After the baptism of their two new relatives, they went to the general store owned by a Rio Grande do Norte entrepreneur to drink beer and soft drinks. The bill was paid by one of the godparents, an entrepreneur who owns another general store down the road and who is emerging as the most upwardly mobile colonist in the area. The men stood or sat in the backroom near the refrigerator, while the women and children stayed in the front room drinking soft drinks. The women shared stories about children, while the men in the back recalled how much partying had followed baptisms at home. Conversation quickly turned to the lack of social life in Vila Roxa and in the Transamazon in general. The men understood that no one was in any kind of economic condition to engage in such luxuries as partying and drinking. While no one at the party admitted having been economically successful in the last three years, they noted that they thought perhaps by now the "other" local residents had gained enough (tem condições) to be able to start a patron saint feast. While even the entrepreneurs could not yet afford to give cattle as a contribution to the festivities, they thought several people in the area could donate a goat, a sheep, chickens, or pigs to be auctioned in honor of the saint. Such auctions are frequently opportunities for conspicuous spending (Harris, 1956:231-233; Wagley, 1964:195) and several of the party-goers said that they would pay whatever they had to just to keep their own animals. All in all, the cost did not matter they said, since the money would help to beautify the church for the saint.

The favorite saints of their home region were considered as possible choices for the Vila Roxa patron, but none of their feast days fell within a convenient time in the agricultural calendar. They agreed that the feast must be in October, a month of relative inactivity while farmers are waiting to burn their fields and when people have available cash after selling their harvest of rice and beans. The instigators also felt that, since this was a farming community, it would be preferable to choose a male saint, especially one that was legendary as "a worker." No one knew who the patron saint of Altamira was, so this was immediately eliminated as a possible choice. They finally hit upon St. Francis, a choice which was facilitated by already having an image of this saint in the village.[10] They all drank to having made the choice and left the party enthusiastic at the prospect of a festival that would unite the Catholic community.

This reunion was socially significant in a number of ways which serve to exemplify the incipient social organization at Vila Roxa. It involved two important local entrepreneurs, both owners of general stores, and the two of the most successful independent farmers in Vila Roxa. Three out of the four owned over ten head of cattle apiece. Two cattle owners were related by affinal ties, and the third was emerging as the most aggressive patron-entrepreneur in the Vila Roxa area. No Southerners were involved, but a Central-West female, the mayor's secretary, acted as godmother for one of the baptized children. The compadrio thus established at the baptisms served to link two of the most successful independent farmers with the high income earners in the area. This will facilitate receiving personal credit in the future. What is of particular interest is that the bonds of this group run through two sets of female relatives. An enterprising caboclo independent farmer married into one group,[11] and a Central-West family joined through the bonds of coparenthood.

Unlike the traditional Amazonian residents, colonists do not yet seek to improve their economic status through fictive kinship ties with the authorities who make up the upper class in the region. Several factors account for this. First, farmers have little day-to-day interaction with government officials. Second, the officials refuse to get personally involved in the lives of the settlers and often spend only a short time in the area themselves. Upper and lower classes in the Transamazon have no personal socio-economic links. However, those among the settlers who have achieved a modicum of success are guaranteeing this position by associating with each other. In due time, clients may be seeking the help and protection of these patrons.

The Catholic entrepreneurs are essentially following a traditional elitist pattern by re-inforcing their position through fictive kin ties with socio-economic equals (Harris, 1956:153). Among Vila Roxa's brokers, compadrio ties are generally used to re-inforce kinship bonds when they exist or to solidify conterráneo, that is, region-of-origin friendships. While entrepreneurs also began with this latter pattern they have now begun to strengthen their economic links with other successful independent farmers regardless of their state of origin. This broker group is not rich, but in the short period of three years they have achieved a certain measure of success. Each one has cleared well over 25 hectares, each owns some cattle, each has several hectares in pasture, and the two entrepreneurs own general stores that do brisk business. All have numerous pigs and poultry, one owns a pick-up truck, and another is a cooperative vicepresident. Some even own gas stoves, gas lamps and sewing machines; all the women in the families are literate and help either in the stores or on the farm, depending on whether they belong to entrepreneurs' or independent farmers' families.

Such economic well-being has led this small group of three or four men to become informal leaders among the less successful farmers. The impersonal dealings with federal agencies have been unsatisfactory to the majority of Transamazon farmers who are accustomed to personal relationships with their superiors. A well-known Brazilian anthropologist, Diégues Jr. (1973:151-164) has pointed out that most rural Brazilians have learned to live in a fazenda environment and that the absence of such an environment leads to disassociation and isolation. The social structure of rural Brazil is characterized by two extremes: the owner of the land and the laborer. So ingrained is this system that, despite its repeated exploitations, it has persisted and has made its way into the egalitarian society of the Transamazon agrovilas.

To deal successfully with the governmental institutions, a farmer needs to be on a comparable socio-behavioral level. Those farmers who are accustomed to giving deferential treatment to the upper class in rural environments are virtually ignored when they behave this way with busy urban bureaucrats. Such behavior gains them little and even leads to a sense of powerlessness and to ineffective use of institutional resources. Faced with powerlessness, these persons seek the protection and security of a personal patron relationship in which they can engage in balanced reciprocity (Sahlins, 1972:188-200; Johnson, 1971:115). This is not to say that the exchange is equal but that there is an effort on both sides to return services rendered. The entrepreneurs who own general stores are able to extend informal credit to Vila Roxa residents. Although they originally had little intention of doing so, their neighbors were so insistent in their pleas that the entrepreneurs gave in (Adams, 1975:47-48). This extension of credit is not without its benefits to the store-owner. Before such indebtedness, he was faced with a very mobile and uncommitted clientele. Thereafter, clients purchased only in his store, even though prices were not necessarily the most advantageous. The entrepreneurs deal with bureaucratic officials not with deference, but with aggressive confidence, and this attitude proves highly successful.

The entrepreneur with motorized transportation will also carry other colonists to the hospital in cases of emergency. A number of times he has acted forcefully to assure that the patient was well-attended. This sort of intervention is important to persons who have often felt cowered before the physicians and nurses. Gratitude for such "protection" in time of need is usually repayed by buying at the entrepreneur's store and working at his land to pay back debts or to earn wages. This may mean that the other colonist accepts a lower wage than he might get elsewhere, but with his "patron" he knows he has a degree of protection during crises.

The leadership which stems from the entrepreneur's economic status also extends into the social and religious realm. While dances were organized by the 4-S Club and women met socially in the Mothers' Club, the general store is the real community gathering place. The only area of leadership not pre-empted by social workers or the priest, the organization of a patron saint festival, was taken up by the entrepreneurs. They assumed the role of sponsoring the celebrations and organizing the people for it. The celebration was successfully carried out in October, and the Bishop came from Altamira to say Mass. Several auctions and dances had been initiated to collect money to beautify the church. It was truly the first party to be organized without the guidance of a social worker and was, without exception, the liveliest that had been held in the community.

Economic success, then, seems to precede social and religious leadership in incipient communities. Before a certain level of economic well-being was established, no one seriously sought to fill the available positions for socio-economic leadership in the community. The social workers undisputedly ran the parties, club meetings, and even the farmer meetings, but with a minimum of success. The entrepreneurs have begun to fill these gaps and will undoubtedly assume the leadership roles now held by social workers. The patron responsibilities to provide credit, wages, protection, to act as spokesman, and to provide socio-religious leadership have all been assumed by entrepreneurs. This situation is now becoming apparent as many clients refer to their new leaders as patrão. Linguistically, the social roles are being marked to express the realities of the social environment.

This emergence of a patrão class serves to fill a growing gap in local authority. The Colonization Agency is moving most of its personnel to areas further along the highway to administer new regions being opened. The entrepreneurs now provide the services expected of a patron, but are more personal in their manner and more subject to the balanced reciprocities of social systems. As outsiders who never identified themselves with the local immigrant population, the government administrators were beyond the informal social controls of compadrio, credit indebtedness, and neighborliness.

All of the above resources--informational, recreational and religious--are closely associated with economics. The churches, the general store, the medical post, household visiting, the mayor's office and club meetings are places that provide a physical setting for such socio-economic behaviors as labor exchange and credit giving. A population does not live in a vacuum but acts in accordance with the perceived resources at its disposal. The social environment provides such a context. The colonists found out from each other who needed wage laborers, what the going price was for produce, and who was open to extending credit either locally or in Altamira. The social linkages which are shown in daily behavior take shape in such social situations.

NOTES

[1] Social workers and civil servants, in general underwent a degree of "culture shock" in the Transamazon. Culture shock is the occupational disease of people who are suddenly transplanted abroad. The malady is caused in part by communication problems and in part by gnawing feelings of inadequacy (Foster, 1973:191). Such feelings often are expressed by criticizing the local population.

[2] Both administrators and technicians are usually agronomists with the equivalent of a bachelor's degree.

[3] The term moleque commonly means urchin or black urchin. However, its usage by farmers in referring to government agents, had the connotation of "spoiled children."

[4] During our one year residence in Vila Roxa, only two children died, due to croup and asthma. Twenty percent of the households had at least one person who suffered from malaria. Two persons suffered from trauma, and their agricultural labor was much impaired.

[5] Compadrio refers to fictive kin ties which are established during such ritual occasions as baptisms, weddings, and graduations.

[6] Similar to the 4-H Clubs in the United States.

[7] For example, a great deal of time is devoted to discussing feed rations in the animal husbandry course. However, it is usually advocated that the farmer use commercially prepared rations that are suggested in the texts when no supply of such feeds exists locally. The cost would be prohibitive if they were imported, yet no suggestions are offered as to what combination of local grains and tubers would make a viable substitute.

[8] Enormous snakes, frogs, Indians, and disease were imagined to make human life impossible in the Amazon. Encouragement to come to the Amazon sometimes hid the true situation in the area. In one case a pioneer wrote friends that secondary education was available in the villages, when in fact it was available only in town and costs more than

most farmers can bear. One farmer with five children at that level came thinking that they would be able to continue their education at low cost. The children lost a couple of years of schooling until they found jobs that could pay for the cost of attending a private secondary school in town.

[9] Ecumenism, or dialogue among churches, is viewed as a "papist plot" to undermine the faith of those outside the Roman Catholic Church, according to a number of crentes. They produce a number of pamphlets distributed by their churches exposing this plot.

[10] An employee of the colonization agency, who drove the ambulance in the area, had a serious car accident. He made a promessa that if he got well he would buy an image of St. Francis for the Church. He did recover and he bought the image, but the little saint remained in his house since the Vila Roxa Church could not adequately house the saint. This man also happened to be a native of Rio Grande do Norte.

[11] The caboclo who married into this network is successful and is driven forward by his wife, the sister of the successful patron already mentioned. His small family enjoys a fairly high standard of living for the area. What he lacks in a large cattle herd (has only four), he makes up by selling manioc flour, tobacco and other products. His wife also earns a teacher's salary.

CHAPTER IX

GENERAL CONCLUSIONS

A number of things have emerged out of this study of tropical colonization. Basically, these findings can be divided into social, institutional and ecological categories. Each of these three aspects bears upon the basic problem that was initially raised in the Preface: Does human behavior change radically in a frontier area or not? What are the implications of the answer for planned colonization?

Major changes in the colonists' behavior were expected. It was assumed that a heterogeneous population, brought together in planned villages and provided with a variety of modern conveniences would quickly abandon their traditional socio-economic practices. This did not prove to be the case. After three years, most farmers have retained the economic strategies brought from their home states. These strategies do not necessarily include farming one's own land as one's major occupation. Persons with backgrounds as sharecroppers or as wage laborers continue to make a living by such means, despite the many opportunities that encourage them to become independent farm operators. On the other hand, those who previously owned land have performed reasonably well as farm managers, and have been more successful in adapting to the conditions of the area and to the Project goals.

An important factor that should be considered in future planning is the constraint imposed by project evaluations. Most federally sponsored development projects include evaluation which comes within a relatively short period of time, sometimes less than five years from the time of a project's inception. If the intended goals have not been achieved within this time, projects are often cancelled or funds are significantly curtailed. In the Transamazon plans had been made to settle 100,000 families within the first five years. By its third year the Colonization Agency had managed to settle fewer than 6,000 and by that date, the Agency ceased to select and transport colonists at its expense. By 1973, too, food subsidies, tools, furniture, poultry and other benefits had been cut back. The high cost of the Project was criticized, and news releases pointed to a lack of visible results and low levels of farm production.

Part of the problem results from badly stated goals. First, and foremost, a planned colonization project should have specific, obtainable goals (Waterston, 1965:144-166). There is no hiding the fact that many colonization projects stem from political motives. Even when such is the case, however, the project itself should be stated in simple, operational terms or targets. While "relief of social tension" is a noble political goal, it is amorphous and cannot be adequately evaluated. It cannot be assumed that merely moving people from one place to another will relieve such a vague problem (Nelson, 1973:290). A more specific target, such as "relieving the minifundio situation and increasing the farm productivity of this agricultural sector," can be more easily be operationalized and properly evaluated.

Once this type of well-focused goal has been stated, it is then possible to choose selection criteria which are appropriate to the achievement of such aims. For instance, the opening of the Brazilian frontier and other lowland areas has as one of its goals increased food production to meet the needs of a growing and increasingly urban population. The minifundio is a serious land tenure problem throughout Latin America. Minifundio holders are doing a remarkable job of food production despite the constraints under which they work (Schultz, 1964). Given the opportunity to acquire more land, they may have a significant impact on food production. The selection of such small landholders, especially those with little past tendency to migrate, would seem a desirable objective if a measure of success and permanency is needed in a new land development project. As was indicated earlier, colonists who were frequent migrants, often came from a sharecropping and wage-labor background. These colonists are seemingly unable to make a successful venture out of farming in the Transamazon.

The colonization scheme along the Transamazon highway was planned for a rather homogeneous population. Hardworking but poor Northeasterners (75 percent) were to learn better farming techniques from the other 25 percent made up of experienced farm managers from Southern Brazil. Instead, a much smaller Northeastern population was actually settled, and a sizable and unexpected flow of Amazonian and Center-West migrants appeared. Also, while the proportion of Southerners was accurately predicted, 19 percent of these settlers were ex-sharecroppers rather than experienced farm managers. Often they had a lot more to learn about managing a farm that many of the Northeastern and Amazonian colonists. This great human diversity among the settlers was unexpected and quite baffling to the Project administrators.

Another fundamental oversight was the lack of awareness of how the relation between urban civil servants and rural colonists would affect the operationalizing of project goals. Most of the colonization agencies involved in the welfare of the newcomers received funds to provide services for this migrant population. The impact of these agencies and their workers was expected to be significant. However, as most of the employees of these agencies came from urban backgrounds, they held little appreciation for, or understanding of, farm life. Civil servants, in general, do not share the same attitudes and values as do farmers. The Transamazon case is representative of a wider national dichotomy between the Brazilian urban ethos and the rural way of life (Wagley, 1964: 269). This distance is expressed in numerous ways and has been described by Harris (1956:274-289). Ethos is defined by Harris as a "complex of interconnected values; a major orientation." Harris states that the urbanethos includes the values of disapproval of agriculture and manual labor in general, the desire to wear "city clothes," noise, "movimento," and houses close together. A low value placed on knowledge of the countryside. People place a low value on conformity and cherish individualism. Harris believes this urban ethos to be an integral part of Latin American culture in general. The urban dweller does not seriously believe that rural people can be educated nor integrated into a modern economy. This attitude was reflected in the current colonization scheme. The Northern and Northeastern populations were viewed as backward and incapable of anything but low-skilled farm labor. The civil servants did not attempt to understand nor utilize the rural ethos in their plans. For them this would result not in development but rather in accepting underdevelopment. Therefore, they attempted to impose a plan without the flexibility of situational modifications. This bureaucratic inflexibility is not simply the result of the nature of bureaucracies, but of the predominance of urban elements in the bureaucratic system.

This rural-urban dichotomy involves not only a cultural and economic conflict within Brazil, but also a conflict of values within each individual. Most Brazilians share national cultural ideals which often conflict with the requirements of their basic socio-economic condition. In the Transamazon such a conflict was displayed even among the members of a colonist family. A farmer, while proud of his agricultural work, always wanted "something better" for his children, and often made great sacrifices to educate them for non-manual urban jobs. In the meantime, he was forced to hire outside laborers to help him operate the farm while the youngsters were in school. The vicious circle often ended when the father became so indebted that he was forced to withdraw his children from school in the middle of a term to help with the agricultural chores. These values of education and non-manual employment are part of what Wagley calls the "gentleman complex" (1963:8-9).

> ... ideal pattern of behavior ... could never have been realized by the large mass of sharecroppers, rural peasants, and urban lower class, and the exigencies of urban life make many of these patterns an impossibility for the modern middle class. As soon as the underpriviledged groups move upward into the middle class through education and income, they seek white-collar jobs, and tend to look down on manual labor. In other words, they share vicariously in the gentleman complex.

The dilemma of the "gentleman complex" of urban civil servants vis-à-vis the very real need for local services might be solved through the informal training of local young men and women for such positions.

Presently, several of such people work at experimental stations or in odd jobs. Some have a few years of secondary education. In the case of the agronomic station, for instance, these young workers might be trained on-the-job actually to run the agricultural experiments. Within a few years they might be paid comparable salaries as extensionists to visit and consult with local farmers. These young trainees would not feel the need to emphasize great social distance between themselves and the farmers, as they are the offspring of other colonists. They also presumably would lack the disdain for manual labor and the reluctance to going to difficult forest areas, shown by urban extension agents, since they would be well accustomed to the Transamazon area, and since they would lack the status that comes with "formal" education. As their homes and families are nearby, they would be more likely to stay in the area and not feel that their work is a "hardship." Such a training program might also be instigated to train interested area residents to take over primary school teaching positions and the role of community health aides.

While planners assumed that trained urban personnel would provide settlements with able leaders, in fact, this assumption had the effect of limiting the development of local leadership. Community leaders developed over time, but only in those activities which were not controlled by government agents. This would suggest that local leadership might have assumed control over other areas as well if they had not been assumed by outsiders. Incipient forms of community leadership were being displayed by local entrepreneurs and independent farmers. Once such individuals had achieved a modicum of economic success, they turned to those areas of social life where leadership was still needed. Their assumption of these roles brought both respect and admiration from the rest of the community. Yet, these same leaders tended to take on the role of the old patrão. The patron-client dyadic relationship has also begun to develop, a fact which points to the inherent difficulty of creating a "new" society that is much different from the one already known. Such a recurrence of inequality was also noted in socialist Tanzania's rural development (Van Hekken and van Velzen, 1972).

Despite the difficulties of overcoming traditional social patterns, the social environment is particularly important to the achievement of rural development. Aware of this, Transamazon planners have tried to bring the city to the rural area (Camargo, 1973:5) by providing nucleated villages and towns, numerous services, and an elaborate administration. But although nucleated settlements offer many advantages to both the colonists and the administrators (i.e., ease in providing health, education, and other services) this form of residence can create problems for pioneer farmers. Close proximity of houses can and does lead to conflict among neighbors. In the early stages of settlement, putting up fencing is not an important priority for many of the colonists and their animals are often allowed to roam freely. This can be detrimental if the animals enter a neighbor's vegetable garden and destroy crops. To avoid such conflict, some farmers restrict their backyard gardening and other subsistence practices.

While services such as schooling and first aid care are available in some agrovilas, they are often absent in others. When this is the case, the advantages of living in one's lot outweigh the difficulties of living in a service-less agrovila. As shown in Figure 8 (Chapter II), there was a great contrast in available services between planned villages along the main highway and those located on side roads. The latter are being abandoned due to the lack of services. This would suggest that if nucleated settlements are to be built they should be located only along the main highway so that health, education and informational services can be continually and effectively provided in the early years of settlement.

One of the greatest disadvantage of the current pace of settlement is the inadequate provision of access roads. This problem resulted from the speed with which the main highway artery was built and the unexpected high costs which were involved. While the rapid construction of the Transamazon highway was politically understandable, the accompanying neglect of side roads seriously limited agricultural production. Only farmers with lots along the main highway were in a position to market all of their production easily. If increased food production is one of the leading objectives for developing new lands, then in this case the side roads should be accorded the same construction and maintenance priority as the main highway itself. One alternative that might be considered is to allocate lots only along the main highway artery in the future. This would prevent further transportation problems, while satisfying the geo-political goal of effectively occupying the area. The side roads could be built and populated gradually, as the new farmers succeed in clearing their first lots and as the farm children grow old enough to own land. In the long run, this arrangement might prevent the future development of minifundia.

If settlement were concentrated only along the main highway, government-owned vehicles would be able to pick up school children and take them to school in the roadside nucleated service centers. After dropping them at the schoolhouse the vehicle might then load up with nurse's aides and serve as a mobile health unit. The children might also serve as vehicles of information about those who were ill that day. This would both increase the effective use of such vehicles and facilitate frequent visits of agency officials to roadside farms. It would also seem practical to locate the school teachers and nurses in a given central area so as to provide them with some social life, unless they prefer to live at home with their farm parents. Such nuclei might become incipient agrovilas which would grow in accordance with the needs of the area.

In addition to resolving the need for better access roads, simplification of the current credit process was also indicated in Chapter VI as one of the major ways to increase farm production and overall productivity. Two general obstacles acted to block the optimum utilization of the available credit facilities. Most colonists are unfamiliar with the use of bank credit. Second, the current credit system is too bureaucratically inflexible. The lack of credit experience on the part of the farmers was already known to the colonization agencies. Nevertheless, neither bank personnel nor extension agents viewed it as their responsibility to educate the farmers as to how to deal with the bank, what credit services were available, and how to manage their loans effectively. Over the years there was little increase in the farmers' knowledge about the banking system. Some have "given up" and decided to avoid any further dealings with the bank. Their disappointment is partially explained by the high costs involved in getting a loan, both in terms of time and money. It has been noted that one-third to one-half of a loan is customarily consumed by transportation costs and the days lost in seeking credit. If agricultural production is to increase, simplification of this credit procedure is necessary.

Along with the above institutional problems, this study has identified some agricultural and ecological problems as well. For example, soil surveys followed rather than preceded the location of farmers on the land. This weakness if one that is often-repeated in tropical land development projects (Nelson, 1973; Dozier, 1969). Funds for such essential research are generally provided only after the settlement project has begun to function, and relocation of colonists from poor farmland to lots with better agronomic potential is costly and difficult. If soil surveys are not possible preceding arrival of colonists, then project administrators might consult with the local population about the location of agronomically useful lands in the area. In Chapter IV it was indicated that Amazonian caboclos were indeed able to pick soils with nigh natural fertility through their use of vegetation criteria.

A further problem, seen earlier in the Papaloapan Project in Mexico, is the tendency for extension agents and project administrators to promote crops which have not been adequately tested in particular environments (Poleman, 1964:141). This, perhaps, may explain the failure in 1972-73 of the rice crop and the continued low productivity of beans mentioned earlier in this study. For instance, since Phaseolus varieties are culturally preferred, they were promoted despite the losses incurred in three consecutive years. Even after such repeated losses, there was little effort on the part of administrators to reconsider their priorities in crop promotion. Production of plants which are highly productive and well adapted to area conditions such as root crops, was neither encouraged nor financed. It would seem that emphasis should be given to crops that have proven their adaptiveness and productivity in the given edaphic environment as a way of minimizing risk in pioneer situations. The most agriculturally significant ecological problem in the Altamira area seems to be the low levels of soil phosphorus, unpredictable rainfall in the dry summer months, and particularly difficult pest and weed problems in cropped fields. These are the areas which perhaps call for the most intensive research, especially in terms of finding plants that do well under these conditions.

Early in this study the question was raised as to the Amazon's potentiality for intensive agriculture. And, more generally, what are the barriers that exist for tropical development? Should major efforts be spend on the South American low and humid tropics or would these efforts be doomed to failure? From this study and from others now available the evidence indicates that developmental difficulties of such tropical regions are not a result of physical environmental inadequacies. Rather, the difficulties are the result of outsiders imposing their cultural and technological knowledge on an environment they do not understand. Amazonian tropical soils are no worse than those of most non-glaciated temperate regions. The climate is hot but with appropriate architectural design there is no reason why life in the tropics has to be unbearable or unattractive. The rains are heavy but they seldom last long and they provide relief from the humidity. Agricultural production has not been spectacular thus far but comparatively little accurate knowledge exists about tropical plant growth to expect otherwise.

The Transamazon Project is not just another colonization scheme that failed. It is an important endeavor, a social, economic, and cultural experiment in one of the world's last great frontiers. There have been problems some of which have been outlined above, but these are not insurmountable. The principal constraints on the Transamazon Project have not been, to date, ecological but, rather, social and institutional. Human beings are always trying to mold their surroundings in familiar forms. This, perhaps more than anything else, is the most serious difficulty to the optimum use of tropical regions by nations in search of economic development.

Human beings cannot escape this tendency to shape the world around them in their image. But they can learn, they can study, and they can act rationally and economically when properly motivated. The Amazon, and similar tropical areas, are vast lands rich in resources. The pity is that most men recognize only a few of the miriad resources that are there. Governments instigating development schemes recognize only the obvious resources: timber, natural rubber, minerals, and wild game. But there is so much more than that. The people who have lived in these areas recognize many more resources than newcomers and outsiders. It is unfortunate that in developing new regions there is so little attention given to the culture of those who developed a system closely adapted to local conditions. The Amazon tropics can be developed and made to contribute to national economic goals; but they will contribute a lot less if we persist in ignoring those already grown accustomed to living in these areas.

Anyone who has visited the city of Belem in the Brazilian Amazon and has tasted the thirty or more exotic fruits and ice creams made there has but a glimpse of what might be done to develop a highly profitable food industry. We need to study the Amazon and what it contains. This is a vast area which is far from homogeneous in soils, topography, and resources. There are areas of too low infertility for intensive agriculture which might, however, be carefully planted in native fruit trees. Rural industries can be established in some localities to process resources of the specific region. There are native plants and trees which might provide raw materials for fruit juices, paints, essences and many other food and industrial purposes. Timber stands might be made more homogeneous and economical without necessarily going to extremes of uniform pine stands planted in North America. Turtle, manatee, capibara and other native animals might be grown in captivity and may provide higher yields than beef cattle (Smith, 1975).

Very little Amazonian native knowledge has been put to use or tested by modern science to date. Pharmacologically, the Amazon and other tropical rain forests are rich in plants with active elements. The question really turns on whether the Amazon region is to be exploited for the benefit of one or two generations or whether we have a longer view of development. The answer lies not in the ecology but in human institutions. If we wish to make use of the full potential resource wealth of the Amazon (and other tropical regions like it) then the first priority should be a focus on region-specific research and development. There are no general answers to the problem of tropical agriculture, for example. Each specific region must be looked at anew and specific strategies developed to make full use of its wealth and adjustments made to its natural requirements. Development does not just mean more people or more machines. It means the improvement of human life and this requires an end to both internal and external colonialism. While it is true that money from taxes levied in the more industrialized area may have to pay for tropical development for a time, this does not justify syphoning out raw materials to these more developed areas. The Amazon region must be freed from the onus of the short-sighted extractive mentality which has plagued it for centuries and has not allowed the full development of local institutions. A major effort should be made for a careful evaluation of both human and natural resources within the Amazon region for permanent and improved human habitation and resource development.

The researcher's viewpoint and analysis of the Transamazon Project has had the advantage of hindsight. It is infinitely easier to criticize constructively a project afterwards, than to plan its development. It is hoped that the results given here may be of help to Brazilian planners and to colleagues interested in the problems of human adaptation and food production in the tropics. Many of the problems raised may already have been recognized and steps taken to correct them. These conclusions and suggestions are offered with full realization of the difficulties of implementing any plan, but with equal awareness of the need to develop the vast lands of the tropical world.

APPENDIX 1

COMMON INSTITUTIONAL AND PLANNING ACHRONYMS

ABCAR:	Associação Brasileira de Crédito e Assistência Rural.
BASA:	Banco da Amazônia S. A.
BB:	Banco do Brasil S. A.
BDM:	Banco de Desenvolvimento do Maranhão S. A.
BNCC:	Banco Nacional de Crédito Cooperativista.
BEM:	Banco do Estado do Maranhão S. A.
CNAE:	Campanha Nacional de Alimentação Escolar.
COBAL:	Companhia Brasileira de Alimentos.
CODEAMA:	Comissão de Desenvolvimento do Estado do Amazonas.
COMARA:	Comissão de Aeroportos de Região Amazonica.
COTELPA:	Companhia de Teléfonos do Pará.
CPRM:	Companhia de Pesquisa de Recursos Minerais.
DNPM:	Departamento Nacional de Produção Mineral.
DNER:	Departamento Nacional de Estradas de Rodagem.
DNOS:	Departamento Nacional de Obras de Saneamento.
EMBRAER:	Empresa Brasileira de Aeronautica.
EMBRAPA:	Empresa Brasileira de Pesquisa Agropecuária.
EMBRATEL:	Empresa Brasileira de Telecomunicações.
EMBRATUR:	Empresa Brasileira de Turismo.
ENASA:	Empresa de Navegação da Amazônia S. A.
FIDAM:	Fundo para Investimentos Privados no Desenvolvimento da Amazônia.
FRAE:	Fundo Regional de Agua e Esgotos.

APPENDIX 1 Continued

FSESP: Fundação Serviço Especial de Saúde Pública.

FUNRURAL: Fundo de Assistência ao Trabalhador Rural.

IBDF: Instituto Brasileiro de Desenvolvimento Florestal.

IBGE: Instituto Brasileiro de Geografia e Estadística.

IDESP: Instituto de Desenvolvimento Econômico-Social do Pará.

INCRA: Instituto Nacional de Colonização e Reforma Agrária.

INPA: Instituto Nacional de Pesquisas da Amazônia.

IPEAN: Instituto de Pesquisa e Experimentação Agropecuária do Norte.

IRDA: Instituto Regional do Desenvolvimento do Amapá.

IRHO: "Institut des Recherches pour les Huiles et Oléagineux" (Instituto de Pesquisas para Óleos e Plantas Oleaginosas).

ITAL: Instituto Tecnológico de Alimentos de Campinas (Centro Tropical de Pesquisas e Tecnologia de Alimentos).

MA: Ministério de Agricultura.

MEC: Ministério de Educação e Cultura.

MOBRAL: Movimento Brasileiro de Alfabetização.

PAN: Plano Aeroviário Nacional.

PIN: Programa de Integração Nacional.

PIPMO: Programa Intensivo para Melhoramento da Mão-de-obra.

PROHÉVEA: Plano Geral de Heveicultura para a Amazônia.

PROTERRA: Programa de Redistribuição de Terras e de Estímulo à Agro-Indústria do Norte e Nordeste.

RADAM: Radar da Amazônia.

SAGRI: Secretaria da Agricultura.

SENAI: Serviço Nacional de Adestramento Industrial.

SERFHAU: Serviço Federal de Habitação e Urbanismo.

APPENDIX 1 Continued

SPVEA:	Superintendência do Plano de Valorização Econômica da Amazônia.
SUCAM:	Superintendência do Contrôle da Malária.
SUDAM:	Superintendência do Desenvolvimento da Amazônia.
SUDECO:	Superintendência do Desenvolvimento da Região Centro-Oeste.
SUDEPE:	Superintendência do Desenvolvimento da Pesca.
SUFRAMA:	Superintendência da Zona Franca de Manaus.

APPENDIX 2

COMMUNITY COMPLEXITY SCALOGRAM

Nome da Comunidade ____________ Km.________Trecho________No. de informantes ____________ Data ______________

I. ORGANIZAÇÕES (ORGANIZATIONS)	NO	Antes de 1971	1971	1972	1973	1974
01. A comunidade é capital do Estado?						
02. A comunidade é sede do Município?						
03. A comunidade tem escritório do INCRA?						
04. A comunidade tem escritório do IPEAN?						
05. A comunidade tem escritório da ACAR-Pará?						
06. A comunidade tem escritório do MEC?						
07. A comunidade tem escritório do IBGE?						
08. A comunidade tem escritório do Banco do Brasil?						
09. A comunidade tem escritório do Banco da Amazônia?						
10. A comunidade tem escritório da Caixa Econômica?						
11. A comunidade tem escritório do FUNRURAL ou Proterra?						
12. A comunidade tem escritório do DNER?						
13. A comunidade tem escritório do Sindicato?						
14. A comunidade tem prefeitura?						

APPENDIX 2 Continued

	NO	Antes de 1971	1971	1972	1973	1974
15. A comunidade tem escritório do PIPMO?						
16. A comunidade é sede de alguma instituição de Previdência Social?						
17. A comunidade tem clube de mães?						
18. A comunidade tem clube 4-S?						
19. A comunidade é sede de cooperativa?						
20. Pertencem membros da comunidade á cooperativa?						
21. A comunidade tem clubes sociais?						
II. EDUCAÇÃO (EDUCATION)						
22. A comunidade oferece curso de normalistas?						
23. A comunidade oferece curso de ginásio?						
24. A comunidade oferece o primário completo?						
25. A comunidade oferece o primário incompleto?						
26. A comunidade tem curso de MOBRAL, MINERVA ou PIPMO?						
27. Existe alguma pessoa com primário completo na comunidade?						
28. Existe alguma pessoa com ginásio completo na comunidade?						
29. Existe alguma pessoa com pedagógico completo?						

APPENDIX 2 Continued

	NO	Antes de 1971	1971	1972	1973	1974
30. Existe alguma pessoa formada de Universidade na comunidade?						
31. A comunidade tem programa de merenda escolar?						
III. INDÚSTRIA (INDUSTRY)						
32. A comunidade tem fábrica de tijolos?						
33. A comunidade tem serraria?						
34. A comunidade tem usina de arroz?						
35. A comunidade tem pessoas que tem casa de farinha?						
36. A comunidade tem un armazém?						
37. A comunidade tem um silos?						
IV. COMÉRCIO (COMMERCIAL)						
38. A comunidade tem algum comércio de géneros alimenticios?						
39. A comunidade tem algum comércio da COBAL?						
40. A comunidade tem algum comércio com geladeira para vender refrigerantes?						
41. A comunidade tem comércios que vendem género não alimenticios?						

APPENDIX 2 Continued

	NO	Antes de 1971	1971	1972	1973	1974
42. A comunidade tem comércio de atacado?						
43. A comunidade tem algum comerciante com veículo própio que traz e vende mercadorias à comunidade (oú tem regatão)?						
44. A comunidade tem um açougue?						
45. A comunidade tem padaria?						
46. A comunidade tem pão fresco cada dia?						
47. A comunidade tem feira semanal?						
48. A comunidade tem hotel ou pensão familiar aberta ao público?						
V. TRANSPORTE (TRANSPORTATION)						
49. A comunidade tem ruas pavimentadas?						
50. A comunidade tem um trapiche ou estação rodoviária?						
51. A comunidade tem serviço de ônibus diário ou regular de barcos?						
52. A comunidade tem serviço de kombi diário ou barcos?						
53. A comunidade tem serviço de táxis dentro da comunidade?						

APPENDIX 2 Continued

	NO	Antes de 1971	1971	1972	1973	1974
54. A comunidade tem aeroporto?						
55. A comunidate tem pista de pouso?						
56. A comunidade tem estrada transitável o ano inteiro?						
57. A comunidade tem vicinal transitável ano inteiro?						
58. A comunidade tem alguma pessoa com veículo particular?						
VI. SERVIÇOS PÚBLICOS (PUBLIC SERVICES)						
59. A comunidade tem escritório do SESP?						
60. A comunidade tem escritório da SUCAM?						
61. A comunidade tem iluminação todo o tempo?						
62. A comunidade tem caixa d'agua do SESP?						
63. A comunidade tem encanamento dentro da maioria das casas?						
64. A comunidade tem poço do SESP?						
65. A comunidade tem praça enfeitada? (i.e., bancas, luz, estátuas, grama, asfalto)						
66. A comunidade tem área central desmatada?						

APPENDIX 2 Continued

	NO	Antes de 1971	1971	1972	1973	1974
VII. SAÚDE (HEALTH)						
67. A comunidade tem farmácia?						
68. A comunidade tem serviço médico?						
69. A comunidade tem médico residindo?						
70. A comunidade tem médico que visita regularmente?						
71. A comunidade tem enfermeira residindo?						
72. A comunidade tem hospital?						
73. A comunidade tem parteira?						
VIII. COMUNICAÇÕES (COMMUNICATIONS)						
74. A comunidade tem escritório da COTELPA?						
75. A comunidade tem escritório do Correio?						
76. A comunidade tem escritório do Telegráfos funcionando?						
77. A comunidade tem jornal ou outra publicação própia?						
78. Se vendem jornais ou revistas de Belém ou de fora na comunidade?						
IX. DIVERTIMENTO (ENTERTAINMENT)						
79. A comunidade tem cinema toda semana?						

APPENDIX 2 Continued

	NO	Antes de 1971	1971	1972	1973	1974
80. A comunidade tem conjunto própio?						
81. A comunidade tem festas organizadas pelo ACAR, pelo padre ou pelo prefeito?						
82. A comunidade tem festas não organizadas pelo ACAR, ou pelo padre?						
83. A comunidade tem time de fútebol que joga representando á comunidade?						
84. A comunidade tem área esportiva pavimentada?						
85. A comunidade tem alguma diversão noturna?						
X. HABILIDADES (SKILLS)						
86. A comunidade tem algum carpinteiro residindo?						
87. A comunidade tem algum tratorista residindo?						
88. A comunidade tem alguns operários de maquinárias residindo?						
89. A comunidade tem algum extensionista residindo?						
90. A comunidade tem alguma polícia residindo?						
91. A comunidade tem algum electricista residindo?						
92. A comunidade tem algum motorista residindo?						

APPENDIX 2 Continued

	NO	Antes de 1971	1971	1972	1973	1974
XI. RELIGIÃO (RELIGIOUS)						
93. A comunidade tem igreja matriz com bispo residindo?						
94. A comunidade tem padres visitantes?						
95. A comunidade tem igreja ou capela própia?						
96. A comunidade tem igreja ou capela de crentes?						
97. A comunidade tem cultos de crentes?						
98. A comunidade tem beata ou rezador ou "irmão" responsável por cultos?						
99. A comunidade tem enterros aqui?						
100. A comunidade tem casamentos aqui?						

XII. OUTRAS PERGUNTAS (OPEN-ENDED QUESTIONS)

a) Com quais comunidades esta comunidade tem mais relacionamento?

b) Onde a gente vai passear? de compras? vender a produção?

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*Based on 100 points. It has the potential of being scaled for each year since the Transamazon Communities emerged and account for increased or decreased services.

APPENDIX 3

INTERVIEW SCHEDULES

MEN'S QUESTIONNAIRE

Entrevista N^{o} ________ Data ___________ Entrevistador ______________________

gleba __________ lote ___________ agrovila ________________________ km.

data que chegou a TA ________ que começou a trabalhar no lote ___________

Censo de todos os habitantes da casa

Nome completo	Sexo	Idade	Relação a chefe da casa	tem lote?	Onde nasceu

O (A) senhor (a) tem filhos morando em qualquer outra parte?

____

____

____

O (A) senhor (a) mora no lote ____ numa agrovila ____ beira estrada _______

A que distância fica o lote de sua casa? _______ m/da roça, do rancho ____

Distância de Altamira _________ km. distância do km. 46 _________________

Meio de transporte: _________ de cavalo _________ a pé ____________ outro

Quantas vezes por mês o (a) senhor (a) vai para o lote? _________________

Costuma ficar quanto tempo cada vez? ____________________________________

Com quem o (a) senhor (a) costuma caminhar para o lote? _________________

São parentes ____, amigos ____, vizinhos _____, coterrâneos ____ _________

correligionários _______? Com quem o (a) senhor (a) escolheu o lote?

Escolhi sozinho (a) ______________ ou com conselho de outros? _______

Com conselho de quem? ____

Quais são os lugares onde o chefe da casa já morou? (Começando com nascimento)

Nome do lugar	Nº anos ficou	Trabalhou em	Salario por mes dia ano	Porque deixou	Morou na área rural ou urbana

Quais são os lugares onde a dona de casa Já morou? (Dando os mesmos datos) ____

____

____

Qual é a profissão dela? _______________Não tem ____________________

Se o senhor trabalhava na agricultura antes de vir para cá:

Trabalhou em terra de outro? ____ A sua? ____ Se fosse de outro, qual era o tipo de arranjo com o patrão? ______________________________
(meia, renda, etc.)

Que costumava plantar? ____

______________________(Nota quanta terra empregava em cada colheita)

Como se fazia o plantio? Tinha broca____? Derruba ____? Coivara ____ ? Queima ____ ? Como se plantava em sua terra? Usava adubos? __________ inseticidas? ________________ sementes selecionadas? ____________

Renda por ano? _______ Usava o banco para financiar?____sim ____ não
e.g. 1969

O patrão financiava? ____sim ____não

Como foi que soube da TA? média____; amigo____; correligionários____;

INCRA_____; outro meio_____. Deixou alguma coisa atraz? ___sin ___não

Que? ____

Se fosse propriedade, quem administra? ___________Renda? _____________

Vendeu alguma coisa antes de sair? ___________Quanto? _____________

Como usou esse dinheirinho? ________________________________

Fez viagem por conta do INCRA?_____ Como? avião_______barco _________,

ônibus _________, outro medio (qual) ____________________________

Pertence ao sindicato? ____, a coop?_____, religião? ____ desde ______ ano

Compra comida onde? ________ Dão crédito? ___________ Quanto? ________

Tem rádio? ____

Dias de serviço empregados em

	Brocar	Derruba		Queimar	Coivarar	Plantar	Colheitar
		dias	área				
Arroz							
Feijão							
Milho							
Mandioca							
Outros							

Desde que o senhor chegou, qual foi a:

Ano	Area desmatada	Queimada ou sapecada?	Plantada	Plantada em terras de outros
1971				
1972				
1973				
1974 (projetada)				

Projetos iniciados pelo senhor desde que chegou:

Ano	Que plantou	Area ou mudas	Semente de quem	Quantidade de semente	Produziu quanto?	Quanto para uso caseiro?	Quanto guardou para semente?
1971							
1972							
1973							
1974 (proj.)							

Da colheita, o senhor vendeu alguma parte?

Ano	Quantidade vendida	A quem?	Preço por unidade	Trocou com outros (quantidade)	Como tirou do lote?
1971					
1972					
1973					
1974 (proj.)					

Faça o favor de desenhar a roça plantada agora e a distribução das coisas plantadas. (Identifica a roça ao lote total e a travessão ou estrada; localiza rancho).

Fruteiraa do mato? Nomes número usa ____________

Fruteiras plantadas? Nomes número producão ____________

O senhor caça no mato? _____ Frequência ______ Pesca? ____ Frequência ____

Quantidade pegou semana passada? ____________ de qué? ____________

Quantidade acostuma pegar por mes? ____________

Varia em inverno e verão? _______ Vendeu caça a outras pessoas? ________

Quantidade ____________ Valor ____________ Frequência ____________

Com quem acostuma caçar/pescar? ____________

São: Parentes? ____ Amigos? ____ Vizinhos? ____ Conterrâneos? ________

Correligionário? ____________

Que tipo de mato indica terra boa? ____________

Quem diz para o senhor? (origem) ____________

Usou para escolher seu lote? ______ Tipo de terra no lote ____________

Acidentado _________ igarapés (n^o) ________ declive __________ Côr ________

Animais domésticos possuídos

Quais?	Uso	Preço de compra	De quem	Ano	N^o	Frequência de uso	Perdeu que número?

Desde que chegou, vendeu algum? ____________

O que é que os animais produzem? ____________

Animal	N^o	Produção	Quantidade	Uso doméstico	Vendido	Valor	Onde	Troca Salario

Ferramentas possuídas (ou que trouxe):

Ano	Tipo de Ferramentas	Preço	Vendedor	Anos de uso Projetado
1971				
1972				
1973				
1974				

Ferramentas emprestadas

Tipo	Emprestada a quem?	Relação ao senhor:	Frequência

Membros de família que trabalham na roça durante algum tempo:

Ano	Nome	Idade	Tipo de Trabalho	Dias contribuidos	Valor do trabalho se fosse empregado

Alguma pessoa foi empregada em algum momento para trabalhar na sua roça?

Ano	Nome	Idade	Tipo de trabalho	Dias contribuidos	Salário ou troca?

Teve perdidas na produção?

Ano	De qual produto	Por que?	Qual prega?	Quantidade produzida	Quantidade perdida

Despesas por mês em transporte ______ em comida ______ en remédios______

Tem horta? _____ no lote? _____ em casa ______ uso domésticos _________

Vende hortaliças? ___ Renda por semana ___ mês ___ Todo o ano _________

Tem motoserra? _______Tem título? _____ de que tipo? Regist.___Defin.__

Carta de anuência _________Provisório _________ Não tem ____________

Recebeu instruções de como usar o banco? ________De quem? ____________

Recebeu instruções de como plantar na TA?________De quem? ____________

O senhor (ou membros da família) trabalhou na roça de algum outro? ____

Ano	Nome do trabalhador	Para quem?	Nº dias	Tipo de Trabalho	Salário	Troca recebida

O senhor deixou algum pedaço da sua terra para ser trabalhada por outro?

Quem?	Relação	$ ou troca esperada	Recebeu?

Produziu alguma coisa que deu-lhe renda? (farinha, óleo, móveis, etc.)

Quanto? ____

____

Produto	Ano	Valor recebido	Nº dias utilizados no serviço	Nº horas utilizadas no serviço

Recebeu dinheiro de amigos ou parentes depois de chegar aqui? ________

Quantia _________ Mandou dinheiro a familia, parentes ou conhecidos?__

Quantia _________ A quem? ____

Recebeu dinheiro do governo?_____INCRA_____ Banco______ Outro ________

Dívidas:

Ano	INCRA	BB (ACAR)	Quantia	Para	Juros %	Quanto pagado?	Outras cobranças

Quantos dias esteve doente no ano passado? _____________________ dias.

Desde que chegou ____

Usa serviços do SESP? ___________________ Frequência _________________

Usa serviços de médico particular? _________ Frequência ______________

Usa serviços de farmácia? ________Frequência ______ $/mes ____________

Usa serviços da parteira na sua família? _____________________________

Usa remédios caseiros? ____

Sabia ou aprendeu aqui? ____

Despesas por mês? (total) ____

Nível de instrução do senhor ________________ de senhora ____________

Dos filhos ____

____

Estado civil ____

Pretende ficar? ________ Se não, vai vender? ______________________

Por quanto? $ __________________ Já tem comprador? ________________

Que pretende fazer depois? ____

____

Como espera melhorar a sua situação? _______________________________

____

Quais são os obstáculos ao melhoramento do pessoal na TA? ____________

____

Como podereis ter mais renda? _____________________________________

O senhor está diposto a fazer isto? _________________________________

APPENDIX 3 Continued

WOMEN'S QUESTIONNAIRE

Interview Num. ____________ Gleba ____________ Lote ____________

Interviewer ____________ Procedencia ____________

Date ____________

1. A senhora prefere morar no lote ou numa agrovila? ____________

   Porque? ____

   Se as coisas não saissem bem para voces aqui, acha que preferia

1) Volta para sua terra 2) Vai para outro lugar novo 3) Fica aqui e trata de resolvar as problemas? ____________________

Porque? ____

2. Tem outro parente, parente de seu esposo, ou compadres que mora perto

Sexo	Idade	Relação	Quando chegou?	Lote numero	Mora no lote ou agrovila?	Mora com voces?

3. Tem outrou passoa que não é parente moranda na sua casa? ____________

   sexo idade qual tipo de relação?

4. Quando foi que a senhora e seu esposo se casavan? (ou anos) ________

4.1 A senhora foi casada ou amasiada antes? qual____ teve filhos ______

4.2 Seu esposo foi casado ou amasiado antes? qual ___ Teve filhos ____

4.3 (os filhos dos outros casamantos moran com voces? ________________

4.4 Quantos anos tinham a senhora ________ e seu esposo ______________
quando casavam ou juntavam pelo primero vez?

4.5 Depois do casamento, voces moravam 1) com seus paes? 2) perto ou com os paes dele? 3) perto de nenhum deles?

4.6 Agora voces 1) tem casamento da igreja catolica Quando foi?
2) tem casamento civil
3) ficam amasiados

5.0 Quantos anos tinha a senhora quando teve o primero filho (a)? ____
(ou quantos anos ou meses depois do casamento?)

5.1 Quantos tempos a senhora ficou gestante? __________________________

Gestação	Perdeu na gravidez		naceram vivos?		Idade agora	Moreram		
	macho/femea	mes	machos/femeas	onde		macho/femea	yrs.	onde

5.2 Quanto tempo a senhora amamentou seus filhos _____? E a(o) caçula (o)?
A que horas geraimente amamenta? ____________________________________
Aumento isso com alguma outra coisa? Que? ___________________________
Quando e que começe dar comida de adultos tudo tempo? _____________

5.3 Tem filhos (as) casados? M____ F____ Casavam aqui? M_____ F ________
Onde eles moram agora (com voces, perto de seu lote ou casa, perto dos paes dele (dela), fora daqui?

Machos ____
Femeas ____

5.4 Veces concordavam com o casamento? ___ Eles fugiram? ____ Casavam
na igreja civil ou ambos? _________

6.0 Quanto tempo a senhora ficou em resguardo depois de ganhar um
filho? _______Sempre ficou tanto tempo para cada filho? ___________

6.1 Seu esposo compro algumas comidas ou coisas especiais para a senhora
durante este tempo? ___________ Que? ______________________________

6.2 Teve alguma pessoa para ajudar voce com a trabalho de casa durante o
resguardo? Quem? _____________________ Pagou para os serviços? ___
Quanto? ____________

7.0 Todos seus partos foram normais, ou teve alguns cesareana? ________
Quantos ________ Quantos vezes teve o parto num hospital ou com
medico _______________ e quantos com uma parteira? _______________
Prefere parteira ou hospital aqui? _________ Porque? ______________

7.1 A senhora esta gestante agora? _______vai ter o filho em casa ou no
hospital? ___________________

7.2 A senhora ja foi operada para não ter mais filhos? _______________
Quando _________ Porque? __________ Seus esposo concordou? ________

7.3 A senhora esta usando comprimidos ou outra maneira de evitar filhos?
Qual? _______ A quanto tempo _________ Se parou, porque? __________

7.4 Se pudesse ter qualquer numero de filhos, quantos queria? _________
(Ou o que voce acha é o tamanho ideal para uma familia)? _________

8.0 A senhora usa remedios caseiros como chas ou lambadores feito de
ervas? __________________ Qual ervas? ___________________________
Usou mais remedios caseiros aqui ou na sua terra? _________________

8.1 Aqui usa mais remedios caseiros de que remedios da farmacia? _______
Aprendeu alguns remedios caseiros novos dos outros colonos aqui?___
Quais? ____

8.2 Para que geralmente usa mais remedios caseiros? (em vez de remedios
da farmacia) 1) para problemas de "mulher" 2) para problemas de estomago ou disenteria 3) para febres altas 4) para dores 5) para vermes das crianças 6) para gripes, asma, tosses 7) para feridas e
golpes ____

9.0 Quantos vezes tinha usado o posto do SESP na agrovila? ___________
O hospital em Altamira __________ Para que? _______________________
Quantos vezes consultou com medico particular aqui? _______________
Para que? ____
Quantos vezes consultou só com o farmacetico? _____________________
Para que? ____

9.1 Quantos destes problemas teve seu esposo este ano passado e quantos dias perdeu de trabalho normal?
Malaria ou febres altas ______ G. I. ____________________________
Accidentes ___________________ Pium ____________________________
Problemas com dentes _________ Gripes, asma, etc. _______________
Outro _______________________

9.2 Quantos destes problemas teve a senhora, e quanto tempo perdeu?
Malaria ou febres altas ____ Respir. _____ Menstrual _____________
Accidente __________________ G. I.________ Gravidez _____________
Problemas com dentes _______ Pium ________ Resguardo _____________
Outro ______________________

9.3 Quantos destes problemas tinham as crianças e quanto tempo perderam da escola ou trabalho normal?
Malaria ou febres altas ______ Respir. _______ Accidente _________
Sarampo _____________________ G. I. _________ Vermes ____________
Coqueluche __________________ Pium __________ Dentes ____________
Outro _______________________

9.4 Quanto dineiro geralmente gasta por mes em 1) consultas __________
2) remedios da farmácia ___________

Vida Economica

10. A senhora tinha emprego antes do casamento? ______________________
Quanto tempo? ________ Mais ou menos quanto por mes? _____________

11. A senhora tem emprego agora? Qual? _________Desde quando ________
Quanto ganha por mes? ___________ Onde tem este emprego? _________

12. Teve emprego na sua terra antes de chegar aqui? Quanto tempo? ___
Qual tipo de emprego? ___________ Quanto ganho por mes? __________

13. A senhora tem horta no quintal? _____________ no lote? __________
As verduras são para usou pessoal so, ou vende-se tambem? ________
Se vende, vende aqui perto? _________ Tem frequeses que sempre compram _____________________
Se vende na cidade, onde vende? (COBAL, mercado municipal, para outro vendedores, na rua?) ____________________________________
Quantos freguese tem que sempre compra as verduras da senhora?____
Quantos vezes por semana (ou mes) vai para a cidade? _____________

14. A senhora cria galinhas ou patos? ____ Comprou ou foram dados pelo INCRA? ________ Mais ou menos quantos tem? _______________________
Se vende, vende só aqui perto? _____ Quem é que compra com frequencia (parente, vizinhas, coterraneos, etc.) _______________________
Vende-se tambem na cidade _________________ Onde? _________________
Vende ovos tambem __________ Aqui perto ou na cidade? _____________
Quanto ganha por mes vendendo ovos ______ quanto para as aves _____
Despesas para a comida das aves? __________________________________

15. A Senhora vende outras coisas feitas em casa? (Bolos, beiju, artesanato, vassouras, coisas bordadas, etc.) ____________________
Qual despesa tem para isso? ________Quanto ganha por mes com isso?
____

16. Quantos vezes a senhora tinha ido á cidade este ano? __________
Geralmente vai com seu marido ou não? ____________________
O que é que a senhora faz lá? 1) compra comidas 2) compra remedios 3) vai para o medico ou farmácia 4) para vender coisas 5) para ir ao banco 6) passear ____________________

Quantas das actividades em cima geralmente são feitas por seu marido?
____

17. Quantos vezes a senhora tinha ido ao lote se não mora lá este mes passado? ________ Se vai com frequencia (por mes ou por semana) o que é que a senhora fez lá? ____________________

18. Quando voces fazem compras na cidade compra fiado ou sempre pagam com dinheiro cada vez? ____________________
Qual tipos de coisas geralmente compra fiado na cidade? ________
____
Onde é que compram coisas fiadas ____________________

19. Voces fazem compras no COBAL? Porque? ____________________

20. Se tem uma barraca ou lojinha na agrovila perto de voces, qual tipo de coisa compra lá? ____________________
Compra fiala lá? __________Quanto credito tem lá? __________
Compra mais das coisas de uso diario la do que na cidade? ________

21. Items na casa

Camas ____________________
Redes ____________________
Mesas ____________________
Móveis fabricadas/tipos _____
Pote ____________________
Filtro ____________________
Filtro ceramica __________
Radios ____________________
Vitrolas ____________________
Outro ____________________

Lamparinhas ____________________
Alladins ____________________
Lampião de gas ____________________
Fogão de alenha ____________________
Fogão de carvao ____________________
Fogão de gas ____________________
Bancos ____________________
Cadeiras individuais __________
Maquinas de costurar __________

PURCHASING CHART / PER MONTH

Respondent ____________ Date ____________

Item	Quantity	Price/ Unit	Bought in City	Cash/ Credit	From Iraciete (store)	From Neighbor	Home Produced	Given by	Borrowed from	Given to
Arroz										
Farinha puba										
Farinha branca										
Maizena										
Trigo										
Feijão comun										
Feijão branco										
Favas										
Feijão mulato										
Feijão preto										
Macarrão										
Macaxeira										
Inhame										

Item	Quantity	Price/ Unit	Bought in City	Cash/ Credit	From Iraciete (store)	From Neighbor	Home Produced	Given by	Borrowed from	Given to
Batata doce										
Batatinha										
Beijú										
Tapioca										
Sal										
Açúcar										
Café										
Leite Ninho										
Leite fresco										
Leite Moça										
Creme de leite										
Nescau										
Toddy										
Farinha lactea										
Chá preto										

Item	Quantity	Price/ Unit	Bought in City	Cash/ Credit	From Iraciete (store)	From Neighbor	Home Produced	Given by	Borrowed from	Given to
Chá mate										
Suco de fruta										
Manteiga										
Óleo vegetal										
Óleo de oliveira										
Óleo de babaçú										
Óleo de dendê										
Vinagre										
Molhos										
Tucupí										
Mostarda										
Carne de gado										
Porco de casa										
Galinha										
Pato										

Item	Quantity	Price/ Unit	Bought in City	Cash/ Credit	From Iraciete (store)	From Neighbor	Home Produced	Given by	Borrowed from	Given to
Outras aves										
Cabrito										
Banha de porco										
Toucinho										
Tripa										
Fígado										
Cutía										
Anta										
Tatú										
Veado										
Capivara										
Tartaruga										
Jabutí										
Paca										
Outra caça										

Item	Quantity	Price/ Unit	Bought in City	Cash/ Credit	From Iraciete (store)	From Neighbor	Home Produced	Given by	Borrowed from	Given to
Peixe fresco (tipos)										
Peixe salgado										
Sardinhas frescas										
Sardinhas em lata										
Ovos										
Queijo										
Coalhada										
Mingaus										
Pão										
Bolacha										
Bolos										
Pamonha										
Doces (tipos)										
Refrigerantes										
Cerveja										

Item	Quantity	Price/ Unit	Bought in City	Cash/ Credit	From Iraciete (store)	From Neighbor	Home Produced	Given by	Borrowed from	Given to
Cachaça										
Vinho										
Carne em lata										
Limão										
Laranja										
Lima										
Abacaxí										
Melancia										
Banana										
Banana comprida										
Mamão										
Manga										
Jaca										
Pupunha										
Cacau do mato										

Item	Quantity	Price/ Unit	Bought in City	Cash/ Credit	From Iraciete (store)	From Neighbor	Home Produced	Given by	Borrowed from	Given to
Palmito										
Açaí										
Cupuacu										
Taperebá (cajá)										
Mangaba										
Graviola										
Jenipapo										
Castanha										
Côco										
Outras coisas do mato										
Milho										
Couve										
Alface										
Repolho										
Carurú										

Item	Quantity	Price/ Unit	Bought in City	Cash/ Credit	From Iraciete (store)	From Neighbor	Home Produced	Given by	Borrowed from	Given to
Maxixe										
Abobrinha										
Jarimum										
Tomate										
Beringela										
Cenoura										
Jiló										
Pepino										
Pimentão										
Cebola										
Alho										
Pimenta de cheiro ou malagueta										
Outra verdura										
Passas										

APPENDIX 4

LIST OF MAMMALS WHOSE RANGES EXTEND INTO AREAS AFFECTED BY TRANSAMAZON

Family	Scientific Name	American Name	Portuguese Name
DIDELPHIDAE[1]	*Didelphis* spp.	American Opossum	Gambá
	Caluromys philander	Wooly Opossum	Mucura xixica
	Monodelphis spp.	Short, Baretailed Opossum	Mucura
	Marmosa spp.	Mouse Opossum	Mucura
	Philander opossum	Gray Opossum	Mucura
CEBIDAE[2]	*Aotus trivirgatus*	Night Monkey	Macaco da Noite
	Pithecia monachus	Saki	Cuxiú
	Chiripotes satanas	Red-backed Saki	Paruacú
	Alouatta spp.	Howler Monkey	Guariba
	Cebus spp.	Capuchins	Macaco Prego (*C. apella*); Caiarara (*C. albifrons*; and *C. capucinus*)
	Saimiri sciureus	Squirrel Monkey	Macaco de Cheiro or Sauim
	Ateles spp.	Spider Monkey	Macaco Aranha
	Lagotrix spp.	Wooly Monkey	Macaco Barrigudo
CALLITHRICIDAE[3]	*Callithrix* spp.	Short-tusked Marmoset	Macaco Suin
	Sanguinus spp.	Long-tusked Marmoset	Macaco Suin
MYRMECOPHAGIDAE[4]	*Myrmecophaga tridactyla*	Great Anteater	Tamanduá Bandeira
	Cyclopes didactylus or *Tamandua tetradactyla*	Pigmy, Silky Anteater	Tamanduá-Mirim

Family	Scientific Name	American Name	Portuguese Name
BRADYPODIDAE[5]	*Bradypus* spp.	Maned Tree Sloth	Preguiça
	Choloepus hoffmani or *C. didactylus*	Two-toed Sloth	Preguiça Real
DASYPODIDAE[6]	*Dasypus* spp.	Six-banded Armadillo	Tatú Comun
	Priodontes giganteus	Giant Armadillo	Tatú Canastrão
LEPORIDAE[7]	*Sylvilagus* spp.	Cotton-tail Rabbit	Coelho
SCIURIDAE[8]	*Sciurus* spp.	Tree Squirrel	Coatipurú
CRICETIDAE[9]	*Oryzomys* spp.	Rice Rat	Rato das Taquaras
	Neacomys spp.	Spiny Rice Rat	
	Nectomys spp.		
HYDROCHOERIDAE[10]	*Hydrochoerus hydrochaeris*	Capybara	Capivara
DASYPROCTIDAE[11]	*Agouti paca*	Paca	Paca
	Dasyprocta spp.	Agouti	Cutia
ECHYMYIDAE	*Proechimys* spp.	Spiny Rat	

Family	Scientific Name	American Name	Portuguese Name
CANIDAE[12]	*Cerdocyon thous*	Crab-eating Fox	Cachorro do Mato
	Chrysocyon brachyurus	Maned Wolf	Guará
	Speothos venaticus	Bush Dog	Cachorro do Mato
PROCYONIDAE[13]	*Nasua nasua*	Coatimundi	Coati
	Potos flavus	Kinkajou	Potto, Macaco da Noite
FELIDAE[14]	*Leo onça*	Jaguar	Onça
	Felis pardalis	Ocelot	Maracajá-Açú
	Felis wiedii	Margay	Maracajá-Mirim or Gato Mirim
	Felis concolor Schr.	Puma	Onça Suçuarana
TRICHECHIDAE[15]	*Trichechus inunguis*	Manatee	Peixe-boi
TAPIRIDAE[16]	*Tapirus terrestris*	Tapir	Anta
TAYASSUIDAE[17]	*Tayassu pecari* Link.	White-lipped Peccary	Queixada
	Tayassu tacaju Linn.	White-collared Peccary	Caitetú
CERVIDAE[18]	*Mazama americana* Erx.	Brocket Deer	Veado Capoeiro

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Source: n/a Position paper from the Master's Program in Tropical Botany. Manaus, Instituto Nacional de Pesquisas da Amazônia, 1973. Special thanks to Dr. Ghillean Prance for making this and other materials available.

NOTES

[1] Doubtful that this ancient and tenacious family would suffer significant harm. Most of the species are omnivorous.

Caluromys eats fruits, seeds, vegetables, birds and reptiles.

Monodelphis in one of the species is *domesticus* due to its habit of living with humans. Could even lead to bigger population, as long as enough trees are left up to permit nesting habits.

Didelphis is hunted when considered a pest. Its fur is of little use.

[2] Arboreal monkeys, highly mobile and traveling in groups (of up to 40 individuals for *Alouatta*). Need a large territory for feeding and keeping distance from other groups. Forest clearing could harm them, just as being hunted for food could (esp. *Lagothrix* and *Ateles*). In Altamira, *Cebus apella* is the most commonly hunted species. Increase use of some as pets and for laboratory research could further deplete population. *Lagothrix* brings over US$150 in United States pet shops. To capture young ones for sale, mother is often shot.

[3] Delicate and highly susceptible to disease and death in captivity. Changes in the habitat will lead to a drop in population density.

[4] The giant anteater is not legally protected and the status of the population is unknown. It is hunted for food. It is found in both forest and savannah.

[5] Arboreal and living on a diet of young leaves, twigs, and buds of *Cecropia*. If enough forest is left it could do well due to the growth of *Cecropia* during secondary sucession. Population status is unknown.

[6] The giant armadillo is a forest species, preferring areas near water and weighs up to 60 kilos.

It is easily caught and is hunted for its meat. It is an endangered species, still unprotected. Population size unknown.

[7] Doubtful that harm will come to this group. With predator numbers decreased, population is likely to increase. Will feed on farm produce.

[8] Coatipurú hunted for meat, may decrease in numbers due to clearing of forest.

[9] The black rat (*Rattus rattus*) may compete with native species. Will probably increase near human population. They carry numerous diseases: bubonic plague, typhus, *Salmonella* food poisoning, rabies, tularemia and trichinosis.

[10] Skin and meat are highly desirable. Mainly found near water and offer easy targets. The largest rodent in the world.

[11] Paca and cutia are hunted for their meat. They are often regarded as agricultural pests. After major game is no longer available, their population seems to hold out well and is an important protein source for colonists. Cutias are an important dispersal agent (through burying of nuts) and maintain a useful symbiosis with other mammals less able to crack the hard tropical nuts (e.g., cutia opens the cupuacu nut and veado and others complete eating the inside). Paca is least remoso of game meats (with deer). It is therefore most acceptable for consumption and sale. Paca is largely nocturnal and cutia diurnal.

[12] Persecuted as pests. *Crysocyon* is very rare (population estimate 1-2,000).

[13] Hunted for meat, very common in the Altamira area.

[14] Much sought for their fur. Can bring up to Cr$1,200 (price now is Cr$700 due to "risk" of being caught or so is the hunter told by the *regatão*).

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[15] Threatened and endangered species.

[16] Hunted for its meat. Sells for more than pork but less than cattle. Usually found only in less disturbed areas of forest. Has the habit of running into the water to escape from hunting dogs, it is then shot.

[17] May be threatened but has wide dispersal throughout South America.

[18] Seem to have done well. Its meat is among the least "gamy" and, therefore, preferred.

APPENDIX 5

PLANTS CULTIVATED BY TRANSAMAZON FARMERS

Local Name	Scientific Name	Uses*	English Name
Abacaxí	*Ananas comosus* Merril.	Food	Pineapple
Abóbora	*Cucurbita* spp.	Food	Pumpkin Squash
Alface	*Lactuca sativa* Linn.	Food	Lettuce
Alfazema	*Ambrosia* spp.	Medicine	Lavender ?
Alfavaca	*Ocimum basilicum* Linn.	Medicine	Basil
Algodão	*Gossypium arboreum*	Medicine Other	Cotton
Araruta	*Maranta arundinacea* Linn.	Food	Arrowroot
Arroz	*Oryza sativa* Linn.	Food	Rice
Arruda	*Ruta graveolens*	Medicine	Rue
Banana	*Musa* spp.	Food	Banana
Batata de Purga	*Convolvulus operculatus*	Medicine	Bindweed or jalap
Batata Doce	*Ipomoea batatas* Linn.	Food	Sweet Potato
Berengela	*Solanum melongena* Linn.	Food	Eggplant
Caatinga de Mulata	*Leonotis neptaefolia*	Medicine	?

Local Name	Scientific Name	Uses*	English Name
Cacau	*Theobroma cacao* Linn.	Food	Cacao
Cajueiro	*Anacardium occidentalis* Linn.	Food Medicine	Cashew
Cana	*Saccharum officinarum*	Food	Sugar Cane
Capim Santo	*Cybopogon nardus*	Medicine	?
Cará	*Dioscorea* spp.	Food	Yam
Carurú	*Amaranthus oleraceae*	Food	Caruru
Cebolinha	*Allium cepa*	Food Medicine	Green Onion
Côco	*Cocus nucifera* Linn.	Food	Coconut
Coentro	*Coriandrum sativum* Linn.	Food	Young Coriander
Couve	*Brassica oleracea*	Food	Cabbage Relative
Erva Doce	*Pimpinella anisum* Linn.	Medicine	Anise
Fava	*Vicia faba*	Food	Broadbean
Feijão Andú	*Canjanus indicus* Spreng.	Food	Pigeonpea
Feijão Comum	*Phaseolus vulgaris* Linn.	Food	Cowpea or Black-Eyed Pea

Local Name	Scientific Name	Uses*	English Name
Fumo	Nicotiana tabacum	Medicine Other	Tobacco
Gergilim	Sesamum indicum DC	Food	Sesame
Gingibre	Zingiber officinalis	Medicine	Ginger
Goiaba	Psidium guayava Raddi.	Food Medicine	Guava
Graviola	Anona cherimolia Mill.	Food	?
Hortelã	Mentha spp.	Medicine	Mint
Inhame	Dioscorea spp.	Food	Yam
Jilo	Solanum gilo	Food	?
Jurubeba	Solanum paniculatum	Food	?
Laranja	Citrus aurantium	Food	Orange
Limão	Citrus limonum	Food	Lime
Macaxeira	Manihot esculenta Crantz	Food	Sweet Manioc
Mamão	Carica papaya Linn.	Food	Papaya
Mamona	Ricinus communis	Food Medicine	Castor Bean

Local Name	Scientific Name	Uses*	English Name
Mandioca	*Manihot esculenta* Crantz	Food	Bitter Manioc
Mangericão	Ocimum minimum	Medicine	?
Mangerona	*Origanum majoranum*	Medicine	Wild Marjoram
Maracujá	*Passiflora edulis* Sims.	Food	Passion Fruit
Maravilha	*Mirabilis* spp. ?	Medicine	?
Mastruz	*Chenopodium ahthelminthicum*	Medicine	Wormseed
Maxixe	*Cucumis anguria*	Food	?
Melancia	*Citrollus vulgaris* Schrad.	Food	Watermelon
Milho	*Zea mays* Linn.	Food	Corn
Mostarda	*Sinapis chinensis*	Medicine	Mustard
Ortemisa	*Anthemis nobilis*	Medicine	Camomile Daisy
Pião Roxo	*Jatropha curcus*	Medicine Other	?
Picão	*Bidens dentata*	Medicine	?
Pimenta Malagueta	*Capsicum frutescens* Linn.	Food	Red Peppers
Pimenta do Reino	*Piper nigrum*	Food	Black Pepper

Local Name	Scientific Name	Uses*	English Name
Pimenta de Xero	?	Food	Yellow Pepper
Pimentão	*Capsicum anuum* Linn.	Food	Bell Peppers
Poejo	*Mentha pulegium*	Medicine	Pennyroyal
Quiabo	*Hibiscus esculentus* Linn.	Food	Okra
Rosa Branca	*Rosa alba*	Medicine	Rose
Repolho	*Brassica oleracea*	Food	Cabbage
Sabougueiro	*Sambucus nigrum*	Medicine	Black Elder
Taioba	*Xanthosoma* spp.	Food	Yautia
Tangerina	*Citrus nobilis*	Food	Tangerine
Tomate	*Lycopersicon esculentum* Mill.	Food	Tomato
Transagem	*Plantago major*	Medicine	?
Vassourinha	*Scoparia dulcis*	Medicine	Broom
Xurú	*Sechium edule* Jacq.	Food	Chayote

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*The various medicinal uses of the plants herein indicated are studied by Millicent Fleming-Moran, "The Folk View of Natural Causation and Disease in Brazil and Its Relation to Traditional Curing Practices." M.A. Thesis: University of Florida, 1975.

APPENDIX 6

WILD FRUITS OF THE ALTAMIRA AREA*

Portuguese Name	Scientific Name
Açaí	*Euterpe oleracea* Mart.
Araçá	*Psidium araca* Raddi.
Babaçú	*Orbignya martiana*
Bacaba	*Cenocarpus bacaba* Mart.
Bacurí	*Platonia insignis* Mart.
Burití	*Mauritia vinifera*
Biribá	*Rollinia orthopetaia* DC or *R. mucosa*
Castanha-do-Pará	*Bertholletia excelsis*
Cacau**	*Theobroma* spp.
Cupuaçú	*Theobroma grandiflorum*
Fruta-pão	*Artocarpus incisa* Linn.
Graviola**	*Anona cherimolia* Mill. or *Anona muricata*
Ingá	*Inga edulis* and spp.
Jambo	*Jambosa vulgaris* DC or *Eugenis mulacensis*
Jenipapo	*Genipa americana* Linn.
Mangaba	*Hanconia speciosa* Gomes
Muricí	*Byrsonima crassifolia* Lam. or *Verbascifolia sericea* DC
Mirití	*Mauritia flexuosa* Linn.
Piquí	*Caryocar coriacrum* Wittm.

Portuguese Name	Scientific Name
Pupunha	_Guilielma speciosa_ Mart.
Sapotilha	_Acharas sapota_ Linn.
Sapucaia	_Lecythis zabucajo_ Aubl.
Taperebá***	_Spondias lutea_ Linn.

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*The Altamira Region is unusually poor in wild fruits.

**Graviola and cacau have almost assumed domesticated status due to their preference by farmers.

***Also known by the name of _cajá_.

APPENDIX 7

METHODS USED IN THE ANALYSIS OF SOILS

Calcium and Magnesium, and Aluminum were extracted using a one normal solution of KCl. Using 100 ml. of extracting solution and 10 ml. of air dried soil in an Erlenmeyer flask of 125 ml.; the mixture is agitated for five minutes in a circular horizontal agitator. Let rest overnight, taking care to break up the soil aggregations in the center of the flask. On the following day, without filtrating, fill two pipettes of 25 ml. each.

To determine Aluminum place 3 drops of blue bromothymol at 0.1 percent, and titrate with 0.025 N NaOH protected against CO_2. The number of ml. corresponds to milliequivalents per 100 grams of soil of exchangeable Aluminum.

To determine Calcium and Magnesium place 3 ml. of a mixture of buffer, cyanide, and triethylamine. Titrate with 0.025 N EDTA (Disodium Salt) using Eriochrome as an indicator. It is important that the three drops of indicator should be placed immediately before beginning titration. If they are added towards the end of the titration and the indicator pales in color, add two more drops of the same. The number of ml. corresponds to milliequivalents per 100 grams of soil of Calcium plus Magnesium.

Mixture: Solution of NH_4Cl in 200 ml. of water together with 600 ml. of concentrated ammonium, 0.616 grams of $MgSO_4 7H_2O$ and 0.930 grams of EDTA (Disodium Salt); complete to make up one liter. Control neutrality in relation to Magnesium and to EDTA.

a)	Cyanide of Potasium at 10 percent	5 drops
b)	Triethylamine	10 drops
c)	Buffer Solution	3 ml.

Place 3 ml. of this solution for the analysis.

Indicator: Eriochrome Black T: dissolve 100 mg. in 25 ml. of methyl alcohol, containing 16 grams of borax per liter. Use 10 to 50 ml. of the indicator each time.

Bromothymol blue: 100 mg. mixed with 1.6 ml. of 0.1 N NaOH. Crush well, until it all has a greenish coloration, and mix with water until making 100 ml.

Phosphorus and Potassium were extracted with solutions of 0.050 N HCl and 0.025 N H_2SO_4. As long as the concentrated acids are good, principally in relation to density, take the necessary volumes in accordance with existing tables. 100 ml. of extracting solution and 10 ml. of air-dried earth in an Erlenmeyer flask of 125 ml; agitate for five minutes in a circular horizontal agitator. Let rest overnight, making sure to break up the soil aggregations in the center of the flask. On the next day, without filtering, extract a 25 ml. pipette of the liquid. Of the 25 ml. take 5 ml. for determination of Phosphorus and the remaining 20 ml. for the flame photometer to determine Potasium.

To determine Phosphorus, in the aforementioned 5 ml., add 10 ml. of an acid solution of Ammonium molybdate already diluted, and a small amount of ascorbic acid. Read the color within one-half to three hours, and count the placement of ascorbic acid. Use a red filter in the colorimeter, Ammonium molybdate solution: in a volumetric flask of 100 ml. place 2 grams of bicarbonate of bismuth and 250 ml. of water. Mix rapidly with 150 ml. of concentrated H_2SO_4. After it cools place the solution of 20 grams of Ammonium molibdate in 200 ml. of water, then complete the liter. To dilute the solution: 300 ml. of the above solution and 700 ml. of water.

To determine pH: To 10 ml. of air-dried fine soil add 25 ml. of distilled water and agitate. After 30 to 60 minutes agitate again and determine immediately the pH with a potentiometer with glass electrode.

To determine Organic Carbon: Place 0.500 grams of air-dried fine soil in a 250-300 ml. Erlenmeyer flask and add exactly 10 ml. of 0.4 N Potassium dichromate and 0.02 grams of powdered silver sulphate. Bring to a light boil and maintain it for five minutes with the test tube full of water as condenser. Cool, add 80 ml. of distilled water, 2.5 ml of concentrated ortho-phosphoric acid and 5 drops of a solution of diphenylamine as indicator. Titrate with a solution of 0.1 N Ammonium ferrous sulfate, until the blue color turns to green. In these conditions, the process is applicable to soils that contain up to 2 percent of carbon. For higher contents of carbon (which is verified when the sample, at the beginning of the boil, takes on a green coloration with no traces of yellow), take 20, 30, 40 or 50 m of 0.4 N Potassium dichromate and after boiling for five minutes, dilute it all to 100, 150 and 200 ml. respectively, taking 50 ml. to titrate with the ferrous salt, after diluting with 50 ml. more of distilled water, this means, that the titration with ferrous salt is always made in a ratio corresponding to 10 ml. of 0.4 N Potassium dichromate.

In cases with a soil sample with an unusually high C content--when even 50 ml. of dichromate are insufficient to oxidize all the carbon in the sample--it is advisable that a smaller sample be taken. Due to the instability of the ferrous sulphate solution, its normality is determined each time that it is used, making a test with 10 ml. of 0.4 N Potassium dichromate.

Calculation of Carbon content: $\% C = 0.06 v(40-n)f$

V=volume of 0.4 N Potassium dichromate used.

n=ml. of -.1 N ferrous salt used in titration.

f=Correction factor for 105° C. This method is essentially the Tiurin method presented at the III International Congress of Soil Science.

Calculation of Organic Matter Content: $O.M. \% = \% C \times 1.72$ (1.72 = factor to transform organic Carbon into Organic Matter).

Process for determining Nitrogen. Weigh 0.5 ± 0.001 grams of TFSA and transfer to a Kjaldhl digestion flask with a capacity of 100 ml. Transfer to inside the flask 15 ml. of digestion solution and place in an electric digestor and heat. Maintain the digestion until all the organic matter has been eliminated from the soil, which is apparent by the clearing of the sample. After the elimination of the organic matter remove from the digestor and cool to ambient temperature. Transfer the residue and liquid to a distillation flask of 100 ml. capacity. Wash well the digestion flask and transfer to the distillation flask until the liquid volume is about 45 ml. Place some pieces of red ceramic to reduce frothing. To receive the ammonia gases place in an Erlenmeyer flask of 125 ml., 10 ml. of H_3BO_3 at 4% and 5 drops of indicator. Immerse the end of the distillation tube in the liquid inside the Erlenmeyer flask. To the distillation flask add slowly 20 ml. of 50% NaOH. Allow the caustic liquid to run down the walls of the flask so that there is no loss of NH_3 while the flask is without a stopper. Cover the flask with a rubber stopper which should be connected to a gas-collecting tube. Agitate vigorously and cool the distillation tubes under a faucet. Turn on the electric coil of the heating plate. Distill approximately 35 ml. of the solution into the distillation flask. Remove from the heating plate. Cool to ambient temperature and titrate with 0.02 N HCl with previously determined factor.

Calculations: 0.5 $\quad$ V x g x 0.00028
100 $\quad$ % N

% N = V x f x 0.056 where f is the acid factor. The above expression should be multiplied by $\frac{0.500}{p}$ where p is the weight of the sample.

BIBLIOGRAPHY

Adams, Richard N.
1956 "Cultural Components of Central America." American Anthropologist 58:881-907.

1975 Energy and Structure. Austin: University of Texas Press.

Alland, Alexander, Jr.
1970 Adaptation in Cultural Evolution: An Approach to Medical Anthropology. New York: Columbia University Press.

American Geographical Society.
1932 Pioneer Settlement. New York: American Geographical Society.

Anonymous
1972 "A População de Amazônia." Jornal da Transamazônica p. 2.

Anonymous
1974a "Green Hell." Newsweek (August 12):55.

Anonymous
1974b Brazilian Information Bulletin (Summer):12-13.

Arensberg, Conrad, and Solon Kimball
1965 Culture and Community. New York: Harcourt, Brace and World.

Baldanzi, Giampiero
1959 Efeitos da Queimada sobre a Fertilidade do Solo. Pelotas, Rio Grande do Sul: Instituto Agronômico do Sul.

BASA (Banco da Amazônia, S.A.)
1971 Programa Especial de Crédito Rural. Belem, Pará: BASA.

Baum, Vicki
1963 The Weeping Wood. Garden City, N. Y.: Doubleday, Doran.

Bennett, John W.
1969 Northern Plainsmen: Adaptive Strategy and Agrarian Life. Chicago: Aldine.

1972 "The Significance of the Concept of Adaptation for Contemporary Socio-cultural Anthropology." Proceedings VIII Congress of Anthropological and Ethnological Sciences S-7:237-241.

Billington, Ray Allen
1967 "The American Frontier." In Beyond the Frontier. Paul Bohannan and Fred Plog, Eds. Garden City, N. Y.: The Natural History Press.

Black, Kenneth
1932 "Health and Climate, with Special Reference to Malaya." Malayan Medical Journal 1:99-107.

Bodard, Lucien
1971 Green Hell. New York: Ballantine Books.

Bohannan, Paul, and Fred Plog (Eds.)
1967 Beyond the Frontier. Garden City, N. Y.: The Natural History Press.

Boserup, Ester
1965 The Conditions of Growth: The Economics of Agrarian Change under Population Pressure. Chicago: Aldine.

Bowman, Isaiah
1931 The Pioneer Fringe. New York: American Geographical Society.

Brunnschweiler, Dieter
1972 The Llanos Frontier of Colombia. East Lansing, Mich.: Michigan State University and Latin American Studies Center.

Buckman, Harry, and Nyle Brady
1969 Nature and Properties of Soils. 7th Edition. New York: Macmillan.

Bushman, Lynn
1974 Field notes.

Byrnes, Francis, and Kerry Byrnes
1969 "Agricultural Extension and Education in Developing Countries." Unpublished Manuscript.

Camargo, José G. de Cunha
1973 Urbanismo Rural. Brasília D. F.: INCRA.

Carter, William E.
1969 New Lands and Old Traditions. Gainesville, Fla.: University of Florida Press.

Castro, Josué de
1967 Geografia da Fome. 10ª edição. São Paulo: Editôra Brasiliense.

Causey, O. R., and C. E. Causey
1974 "Transmissible Disease in the Brazilian Amazon." In Man in the Amazon. Charles Wagley, Ed. Gainesville, Fla.: University of Florida Press.

Chavez, J. M., E. Pechnik, and I. V. Mattoso
1949 "Estudo da Constitução Química e do Valor Alimentício da Pupunha (*Guilielma speciosa*, Mart.)." *Arquivos Brasilienses de Nutrição* 6(3):185-192.

CIAT (Centro Internacional de Agricultura Tropical)
1964 *Small Farms Systems Program*. Mimeographed Manuscript.

Cohen, Yehudi
1968 *Man in Adaptation: The Cultural Present*. Chicago: Aldine.

Coleman, N. T., S. B. Weed, and R. J. McCraken
1959 "Cation Exchange Capacity and Exchangeable Cations in Piedmont Soils of North Carolina." *Proceedings of the Soil Science Society of America* 23:146-149.

Collier, Richard
1968 *The River that God Forgot*. New York: E. P. Dutton.

Conklin, Harold C.
1957 *Hanunóo Agriculture: A Report on an Integral System of Shifting Cultivation in the Philippines*. Rome: Food and Agriculture Organization of the United Nations. Forestry Development Paper No. 12.

1963 *The Study of Shifting Cultivation*. Washington D. C.: Panamerican Union.

Costa, Manoel Augusto (Ed.)
1971 *Migrações Internas no Brasil*. Rio de Janeiro: IPES.

Crist, Raymond
1967 "Tropical Subsistence Agriculture and Settlement." In *Rural Development in Tropical Latin America*. Kenneth Turk and Loy Crowder, Eds. Ithaca, N. Y.: Hoffman and Sons.

Crist, Raymond, and Charles Nissly (Eds.)
1973 *East from the Andes*. Gainesville, Fla.: University of Florida Press.

Cunha, Euclides da
1913 *A Márgem da História*. 2a edição. Porto, Portugal: Livraría Chardron.

da Mata, M., E. W. R. de Calvalho, and M. T. I. I. de Castro e Silva
1973 *Migrações Internas no Brasil*. Rio de Janeiro: IPES.

Davis, Stanley, and L. W. Gordon
1972 *Workers and Managers in Latin America.* London: D. C. Heath.

Diégues Júnior, Manuel
1973 "Populações Rurais Brasileiras." In *Vida Rural e Mudança Sócial*. Tamás Szmecsanyi and O. Queda, Eds. São Paulo: Companhía Editôra Nacional.

Doughty, Paul, Henry Dobyns, and A. Holmberg
1966 Measurement of Peace Corps Program Impact in the Peruvian Andes: Final Report. Washington D. C.: The Peace Corps.

Dozier, Craig
1969 Land Development and Colonization in Latin America. New York: Praeger.

Edwards, David
1961 Report on an Economic Study of Small Farming in Jamaica. Glasgow: Institute for Social and Economic Research.

Edwards, Everett
1940 "American Agriculture: The First Three Hundred Years." In Farmers in a Changing World. USDA. Washington D. C.: U.S. Government Printing Office.

Falesi, Ítalo Claudio
1972 Solos da Rodovía Transamazônica. Belem, Pará: IPEAN. Boletim técnico No. 55.

1974 "Soils of the Brazilian Amazon." In Man in the Amazon. Charles Wagley, Ed. Gainesville, Fla.: University of Florida Press.

Ferdon, E. H.
1959 "Agricultural Potential and the Development of Cultures." Southwestern Journal of Anthropology 15:1-19.

Fleming-Moran, Millicent
1975 "The Folk View of Natural Causation and Disease in Brazil and Its Relation to Traditional Curing Practices." M.A. Thesis: University of Florida.

Foster, George M.
1953 "What is Folk Culture?" American Anthropologist 55:159-171.

1973 Traditional Societies and Technological Change. 2nd edition. New York: Harper and Row.

Foster, George M., and John H. Rowe
1951 "Suggestions for the Field Recording of Information on the Hippocratic Classification of Disease and Remedies." Kroeber Anthropological Society Papers 5:1-5.

Frost, Melvin
1964 Pioneer Settlements in the Pacific Lowlands of Guatemala. Ph.D. Dissertation: University of Florida.

Galvão, Eduardo
1951 "Panema: Uma Crença do Caboclo Amazônico." Revista do Museu Paulista 5:221-225.

1955 Santos e Visagems: Um Estudo da Vida Religiosa de Itá. São Paulo: Companhía Editôra Nacional.

1963 "Elementos Basicos da Horticultura de Subsistência Indígena." Revista do Museu Paulista 14:120-144.

Gates, Paul W.
1960 The Farmer's Age: Agriculture. 1815-1860. New York: Harper and Row.

Glick, Curtis R.
1975 "The Cultural Impact of the Trans-amazon Highway on a Traditional Community." M. A. Thesis: University of Florida.

Gourou, Pierre
1966 The Tropical World. 4th edition. New York: Wiley.

Grigg, D. B.
1974 The Agricultural Systems of the World. London: Cambridge University Press.

Guilherme Velho, Otávio
1972 Frentes de Expansão e Estrutura Agrária. Rio de Janeiro: Zahar Editores.

Hammel, E. A.
1969 Power in Ica: The Structural History of a Peruvian Community. Boston: Little, Brown.

Hanke, Lewis (Ed.)
1966 Readings in Latin American History. Vol. II. New York: Crowell.

Harris, Marvin
1956 Town and Country in Brazil. New York: Norton.

1968 The Rise of Anthropological Theory. New York: Crowell.

Hasek, V. C.
1971 Casa Tropical de Madeira: um Modelo de Habitação Rural para a Amazônia. Belem, Pará: SUDAM.

Hawley, Amos
1950 Human Ecology. New York: Ronald Press.

1973 "Ecology and Population." Science 179:1196-1201.

Heider, Karl
1972 "Environment, Subsistence and Society." In Annual Review of Anthropology. Vol. I Palo Alto, Calif.: Annual Reviews.

Holdridge, L. R.
1967 Life Zone Ecology. Revised edition. San José, Costa Rica: Tropical Science Center.

Honda, E. M. S.
1972 "Peixes Encontrados nos Mercados de Manaus." Acta Amazônica 2:97-98.

Huntington, Ellsworth
1915 Civilization and Climate. 3rd edition. New Haven, Conn.: Yale University Press.

Hutchinson, Harry
1957 Village and Plantation Life in Northeastern Brazil. Seattle: University of Washington Press.

IBGE (Instituto Brasileiro de Geografía e Estatística)
1970 Sinopse Preliminar do Censo Demográfico da Região Norte. Rio de Janeiro: IBGE.

1972 Estatísticas do Município de Altamira. Mimeographed Manuscript.

IBRD (International Bank for Reconstruction and Development)
1973 Country Report: Brazil. Washington D. C.: IBRD.

IPEAN (Instituto de Pesquisa e Experimentação Agropecuária do Norte)
1967 Contribuição ao Estudo dos Solos de Altamira. Belem, Pará: IPEAN. Circular No. 10.

1973a Relatório Anual (1972-73) da Estação Experimental da Transamazônica. Belem, Pará: IPEAN.

1973b Programa Integrado de Expensão da Pesquisa Agropecuária na Amazônia. Belem, Pará: IPEAN.

1973c Relatório de Atividades (1972-73). Belem, Pará: IPEAN.

1974 Solos da Rodovía Transamazônica: Trecho Itaituba-Rio Branco. Belem, Pará: IPEAN.

Johnson, Allen W.
1971 Sharecroppers of the Sertão: Economics and Dependence on a Brazilian Plantation. Stanford, Calif.: Stanford University Press.

Jurion, F., and J. Henry
1969 Can Primitive Farming be Modernized? London: Agra-Europe.

Kellogg, Charles
1959 "Shifting Cultivation." Journal of Soil and Water Conservation in India 7:35-39.

Kleinpenning, J. M. G.
1975 The Integration and Colonization of the Brazilian Portion of the Amazon Basin. Nijmegen, Holland: Institute of Geography and Planning.

Klinge, Hans, and William Rodrigues
1968 "Litter Production in an Area of Amazonian Terra Firme Forest." Amazoniana 1:287-310.

Kottak, Conrad
1974 Cultural Anthropology. New York: Random House.

Lewis, Oscar
1951 Life in a Mexican Village. Urbana, Ill.: University of Illinois Press.

Margolis, Maxine
1973 The Moving Frontier: Social and Economic Change in a Southern Brazilian Community. Gainesville, Fla.: University of Florida Press.

Mayer, John
1970 The Brazilian Household: Size and Composition. Ph.D. Dissertation: University of Florida.

Meggers, Betty
1954 "Environmental Limitation on the Development of Culture." American Anthropologist 56:801-824.

1971 Amazonia: Man and Culture in a Counterfeit Paradise. Chicago: Aldine.

1974 "Environment and Culture in Amazonia." In Man in the Amazon. Charles Wagley, Ed. Gainesville, Fla.: University of Florida Press.

Meggers, B., E. S. Ayensu and W. D. Duckworth (Eds.)
1973 Tropical Forest Ecosystems in Africa and South America. Washington D. C.: Smithsonian Institute Press.

Melby, John
1966 "Rubber River: An Account of the Rise and Collapse of the Amazon Boom." In Readings in Latin American History Vol. II. Lewis Hanke, Ed. New York: Crowell.

Mellor, John
1968 "The Subsistence Farmer in Traditional Economies." In Subsistence Agriculture and Economic Development. Clifton Wharton Jr., Ed. Chicago: Aldine.

Mendes, Armando
1974 A Invenção da Amazônia. Belem, Pará: Universidade Federal do Pará.

Ministerio da Agricultura
1972a Altamira 1. Brasilia D. F.: INCRA.

1972b Amazônia: Uma Alternativa para os Problemas Agrários Brasileiros. Mimeographed Manuscript.

1975 Letter of February 6, 1975 to Nigel Smith from INCRA Secretaria do Planejamento (Brasilia D. F.).

Ministério das Minas e Energia
1974 Levantamento de Recursos Naturais. Vol. V. Rio de Janeiro: Departamento Nacional de Produção Mineral (Projeto RADAM).

Moran, Emilio F.
1973 "Energy Flow Analysis and the Study of Manihot esculenta Crantz." Acta Amazônica 3(3):29-39.

1974 "The Adaptive System of the Amazon Caboclo." In Man in the Amazon. Charles Wagley, Ed. Gainesville, Fla.: University of Florida Press.

In Press "Farming Manioc for Tropical Consumption." World Crops.

Mosher, A. T.
1968 "The Development Problems of Subsistence Farmers." In Subsistence Agriculture and Economic Development. Cifton Wharton Jr., Ed. Chicago: Aldine.

Mott, G. O., and H. L. Popenoe
1975 "Ecophysiology of Tropical Grasslands." Unpublished Manuscript.

National Academy of Science
1972 Soils of the Humid Tropics. Washington D. C.: National Academy of Sciences.

Nelson, Michael
1973 The Development of Tropical Lands: Policy Issues in Latin America. Baltimore, Md.: The Johns Hopkins University Press.

Netting, Robert
1974 "Agrarian Ecology." In Annual Review of Anthropology. Vol. III. Palo Alto, Calif.: Annual Reviews.

Nicholls, William
1974 "Changes in the Agricultural Economy of the Brazilian Northeast, 1963-73." Mimeographed Manuscript.

Nietschmann, Bernard
1973 Between Land and Water. New York: Seminar Press.

Nye, P. H. and D. J. Greenland
1960 The Soil Under Shifting Cultivation. Harpenden, U. K.: Commonwealth Bureau of Soils. Technical Communication No. 51.

Odum, Eugene P.
1969 "The Strategy of Ecosystem Development." Science 164:262-270.

1971 Fundamentals of Ecology. 3rd edition. Philadelphia: Saunders.

Odum, Howard T., and R. F. Pigeon (Eds.)
1970 A Tropical Rain Forest. Springfield, Va.: U.S. Department of Commerce and Atomic Energy Commission.

Odum, Howard T.
1971 Environment, Power, and Society. New York: Wiley Interscience.

Oyama, M., and H. Takehara
1967 Revised Standard Soil Color Charts. Tokyo, Japan: International Soil Science Society.

Paiva, Ruy, S. Schattan, and C. F. Trench de Freitas
1973 Brazil's Agricultural Sector. São Paulo: XV International Conference of Agricultural Economists.

Paul, Benjamin (Ed.)
1955 Health, Culture and Community. New York: Russell Sage Foundation.

Pechnick, E., and J. M. Chaves
1945 "O Açai, um dos Alimentos Básicos da Amazônia." Anais da Associação Química Brasileira 4:169.

Pelto, Pertti, and Gretel Pelto
1975 "Intra-cultural Diversity: Some Theoretical Issues." American Ethnologist 2:1-18.

Pelzer, Karl
1948 Pioneer Settlement in the Asiatic Tropics. New York: American Geographical Society.

Poleman, Thomas
1964 The Papaloapan Project: Agricultural Development in the Mexican Tropics. Stanford, Calif.: Stanford University Press.

Popenoe, Hugh
1960 Effects of Shifting Cultivation on Natural Soil Constituents in Central America. Ph. D. Dissertation: University of Florida.

Pospisil, Leopold
1963 Kapauku Papuan Economy. New Haven, Conn.: Yale University Press.

Price, A. Grenfell
1939 White Settlers in the Tropics. New York: American Geographical Society.

RADAM (Radar da Amazônia)
1974 Levantamento de Recursos Naturais. Vol V. Rio de Janeiro: Ministerio de Minas e Energia.

Rappaport, Roy
1967 Pigs for the Ancestors. New Haven, Conn.: Yale University Press.

Redfield, Robert
1930 Tepoztlán: A Mexican Village. Chicago: University of Chicago Press.

1941 The Folk Culture of Yucatan. Chicago: University of Chicago Press.

1960 The Little Community and Peasant Society and Culture. Chicago: University of Chicago Press.

Reichel-Dolmatoff, G.
1971 Amazonian Cosmos. Chicago: University of Chicago Press.

Reis, Arthur Cézar Ferreira
1942 Síntese de História do Pará. Belem, Pará: n.p.

1968 A Amazônia e a Cobiça Internacional. 3a. edição.

Resende, Eliseu
1973 As Rodovias e o Desenvolvimento do Brasil. Rio de Janeiro: Ministerio de Transportes.

Richards, Paul W.
1964 The Tropical Rain Forest. Cambridge, U. K.: University Press.

Rocha Penteado, Antonio
1967 Problemas de Colonização e de Uso da Terra na Região Bragantina do Estado do Pará. 2 Vols. Belem, Pará: Universidade Federal do Pará.

Rocque, Carlos (Ed.)
1971 Antologia da Cultura Amazônica. Vol. VI. São Paulo: Amazônia Edições Culturais.

Rodrigues Lima, Rubens
1956 A Agricultura nas Várzeas do Estuario do Amazonas. Belem, Pará: Instituto Agronômico do Norte.

Rogers, D. J., and M. Milner
1965 "Amino Acid Profile of Manioc Leaf Protein in Relation to Nutritive Value." Economic Botany 17:211-216.

Ruthenberg, Hans (Ed.)
1968 Smallholder Farming and Smallholder Development in Tanzania. London: C. Hurst.

1971 Farming Systems in the Tropics. London: Oxford University Press.

Sahlins, Marshall
1972 Stone Age Economics. Chicago: Aldine.

Sahlins, Marshall, and E. Service
1960 Evolution and Culture. Ann Arbor, Mich.: Michigan University Press.

Sánchez, Pedro, C. Seubert, E. Tyler, C. Valverde, C. López, M. Nureña, and M. Wade
1974 "Investigaciones en Manejo de Suelos Tropicales en Yurimaguas, Selva Baja del Perú." Paper presented at Seminario de Sistemas de Agricultura Tropical (Lima, Perú). June 1-8, 1974.

Sánchez, Pedro, and S. W. Buol
1975 "Soils of the Tropics and the World Food Crisis." Science 188:598-603.

Santos, Roberto
1968 "O Equílibrio da Firma Aviadora e a Significação Econômica." Pará Desenvolvimento 3:7-30.

Schuh, G. Edward
1970 The Agricultural Development of Brazil. New York: Praeger.

Schultz, Theodore
1964 Transforming Traditional Agriculture. New Haven, Conn.: Yale University Press.

SESI (Serviço Social da Indústria)
1974 "SESI en Ação na Transamazônica: Altamira." Indústria e Produtividade (June):76-80.

Sioli, Harald
1973 "Recent Human Activities in the Brazilian Amazon Region and their Ecological Effects." In Tropical Forest Ecosystems. B. Meggers et al., Eds. Washington D. C.: Smithsonian Institute Press.

Smith, Nigel
1974 Field Notes.

1975 Transamazon Highway: A Cultural-Ecological Analysis of Colonization in the Humid Tropics. Ph. D. Dissertation: University of California, Berkeley (in preparation).

Smith, T. Lynn
1969 "Studies of Colonization and Settlement." Latin American Research Review 4:93-123.

1972 Brazil: People and Institutions. Baton Rouge, La.: Louisiana State University Press.

Spencer, Joseph E.
1966 Shifting Cultivation in Southeast Asia. Berkeley, Calif.: University of California Press.

Spradley, J. P., and D. McCurdy
1975 Anthropology: The Cultural Perspective. New York: John Wiley and Sons.

Stark, N.
1969 "Direct Nutrient Cycling in the Amazon Basin." In II Simposio y Foro de Biología Tropical Amazónica. Bogotá: Editorial Pax.

1970 "The Nutrient Content of Plants and Soils from Brazil and Surinam." Biotropica 2:51-60.

1971a "Nutrient Cycling: Nutrient Distribution in Some Amazonian Soils." Tropical Ecology 12:24-50.

1971b "Nutrient Cycling II: Nutrient Distribution in Amazonian Vegetation." Tropical Biology 12:177-201

1972 "Nutrient Cycling Pathways and Litter Fungi." Bioscience 22:355-360.

Sternberg, Hilgard O'Reilly
1973 "Development and Conservation." Erkunde 27:253-265.

Steward, Julian
1955 Theory of Culture Change. Urbana, Ill.: University of Illinois Press.

1956 The People of Puerto Rico. Urbana, Ill.: University of Illinois Press.

Stewart, G. F., and M. Amerine
1973 Introduction to Food Science and Technology. New York: Academic Press.

SUDAM (Superintendência do Desenvolvimento da Amazônia)
1971 Relatório de Marabá e Altamira. Mimeographed Manuscript.

1972 Relatório Geral. Belem, Pará: SUDAM.

1974 Estudos Básicos para uma Política de Desenvolvimento dos Recursos Florestais na Amazônia. Belem, Pará: SUDAM.

Sutmoller, P., A. Vahia de Abreu, J. van der Grift, and W. G. Sombroeck
1966 Mineral Imbalances in Cattle in the Amazon Valley. Amsterdam: Royal Tropical Institute. Communication No. 53.

Szmrecsanyi, Tamás, and O. Queda (Eds.)
1973 Vida Rural e Mudança Social. São Paulo: Companhía Editôra Nacional.

Tambs, Lewis
1974 "Geopolitics of the Amazon." In Man in the Amazon. Charles Wagley, Ed. Gainesville, Fla.: University of Florida Press.

Tavares, Vania P., C. M. Considera, and M. T. I. I. Castro e Silva
1972 *Colonização Dirigida no Brasil: Suas Posibilidades na Região Amazônica*. Rio de Janeiro: IPES. No. 8.

Tax, Sol
1963 *Penny Capitalism*. Chicago: University of Chicago Press.

Taylor, William
1975 "Time and Community Studies." *Peasant Studies News-Letter* 4:13-17.

Turk, Kenneth, and Loy Crowder (Eds.)
1967 *Rural Development in Tropical Latin America*. Ithaca, N. Y.: Hoffman and Sons.

Turner, F. J.
1920 *The Frontier in American History*. New York: Henry Holt.

Upton, Martin
1973 *Farm Management in Africa*. London: Oxford University Press.

USDA (United States Department of Agriculture)
1970 *Economic Progress of Agriculture in Developing Nations (1950-1968)*. Washington D. C.: USDA. Foreign Agricultural Economic Report No. 59.

Valverde, Orlando, and C. V. Dias
1967 *A Rodovía Belem-Brasilia*. Rio de Janeiro: IBGE.

Van Hekken, P. M., and H. V. E. Thoden van Velzen
1972 *Land Scarcity and Rural Inequality in Tanzania*. The Hague: Mouton.

Vergolino e Silva, Anaíza
1971 "O Negro no Pará." In *Antologia da Cultura Amazônica*. Vol. VI. Carlos Rocque, Ed. São Paulo: Amazônia Edições Culturais.

Veríssimo, José
1970 *A Pêsca na Amazônia*. Belem, Pará: Universidade Federal do Pará.

Waddell, Eric
1972 *The Mound-Builders: Agricultural Practices, Environment, and Society in the Central Highlands of New Guinea*. Seattle: University of Washington Press.

Wagley, Charles
1941 *Economics of a Guatemalan Village*. American Anthropological Association Memoir No. 58. Washington D. C.

1948 "Regionalism and Cultural Unity in Brazil." *Social Forces* 26:457-464.

1951 "The Brazilian Amazon: The Case of an Underdeveloped Area." In Four Papers Presented in the Institute for Brazilian Studies. Nashville, Tenn.: Vandervilt University Press.

1952 "The Folk Culture of the Brazilian Amazon." Proceedings of the XXIX Congress of Americanists. Chicago: University of Chicago Press.

1963 An Introduction to Brazil. New York: Columbia University Press.

1964 Amazon Town: A Study of Man in the Tropics. New York: Alfred A. Knopf.

1968 The Latin American Tradition. New York: Columbia University Press.

Wagley, Charles (Ed.)
1974 Man in the Amazon. Gainesville, Fla.: University of Florida Press.

Waterston, Albert
1965 Development Planning: Lessons of Experience. Baltimore, Md.: Johns Hopkins University Press.

Wesche, Rolf J.
1967 The Settler Wedge of the Upper Putumayo River. Ph. D. Dissertation: University of Florida.

Wharton, Clifton Jr.
1968 Subsistence Agriculture and Economic Development. Chicago: Aldine.

White, Leslie
1949 The Science of Culture. New York: Grove Press.

Willems, Emilio
1967 Followers of the New Faith: Culture Change and the Rise of Protestantism in Brazil and Chile. Nashville, Tenn.: Vanderbilt University Press.

Williams, Sue Rodwell
1973 Nutrition and Diet Therapy. 2nd edition. St. Louis: C. V. Mosby.

Wolf, Eric
1955 "Types of Latin American Peasantry." American Anthropologist 57:452-471.

1956 "Aspects of Group Relations in a Complex Society." American Anthropologist 58:1065-1078.

Yang, W. Y.
1965 Methods of Farm Management Investigations. Revised edition. Rome: Food and Agriculture Organization of the United Nations.

BIOGRAPHICAL SKETCH

Emilio F. Moran was born in Habana, Cuba on July 21, 1946. Travel became a way of life for him: six years in Camaguey, Cuba; five years in Habana; one year in Miami; a year and a half in Habana; and then a final return to the United States where his mobility seemed to increase rather than decrease. He completed high school at Bishop Kenny High School in Jacksonville, Florida. His college years took him to both the University of Southwestern Louisiana and Spring Hill College (Mobile, Alabama). He graduated with honors and was ready to start graduate school with an NDFL Fellowship.

After completing the master's degree in history at the University of Florida, he joined the faculty of Archbishop Curley High School and later became Chairman of Social Sciences. During this period he pursued course work in macroeconomics at the University of Miami and the University of North Carolina. These experiences convinced Mr. Moran that such was not his true inclination. The receipt of an NDFL Fellowship and the development of an attractive program in Anthropology at the University of Florida led him to a new academic discipline. During his Ph.D. program, he developed interests in ecology and tropical agriculture, focusing on the applications of anthropology to problems of agricultural development. After completion of the PhD. he will go to Indiana University at Bloomington, to begin a career of teaching and applied research.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Charles Wagley

Charles Wagley
Graduate Research Professor of Anthropology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Solon T. Kimball

Solon T. Kimball
Graduate Research Professor of Anthropology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

William E. Carter

William E. Carter
Professor of Anthropology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Hugh Popenoe

Hugh L. Popenoe
Professor of Soils

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Neill Macaulay

Neill Macaulay
Associate Professor of History

This dissertation was submitted to the Graduate Faculty of the College of Arts and Sciences and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Dean, Graduate School

August, 1975

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